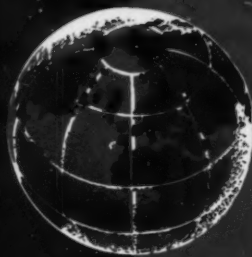


MINING WORLD

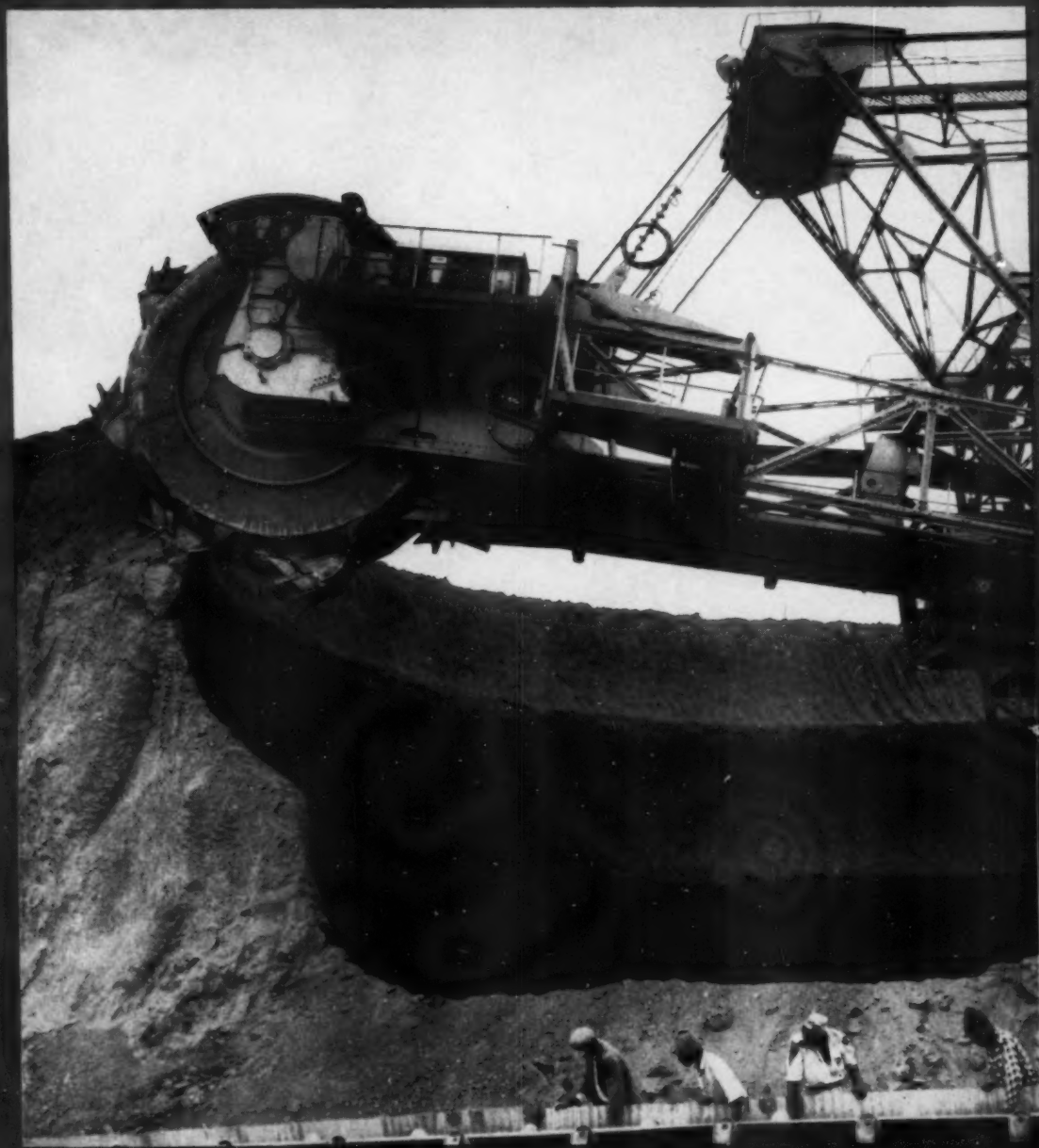


FEBRUARY 1959

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How Cyanamid Floats Coarse
Florida Phosphate Page 32

Why Lucky Mc Uses Moving Bed
Ion Exchange System Page 42



Nchanga's Bucket-Wheel Stripper
Page 40

PRODUCER

The Wemco S-H Classifier:

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of Profitable Production*



Wemco engineering makes the difference where classifiers must give continuing, top production — at low cost.

The distinction: Wemco exclusive features — 75% pitch design for maximum capacity potential through the use of triple pitch helixes, large shaft size and construction, hydraulic lifting device. Wemco S-H Classifiers are *standard* — industry-wide and world-wide.

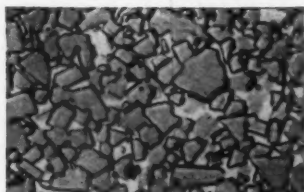


Depend on the Wemco S-H Classifier and the skills behind it

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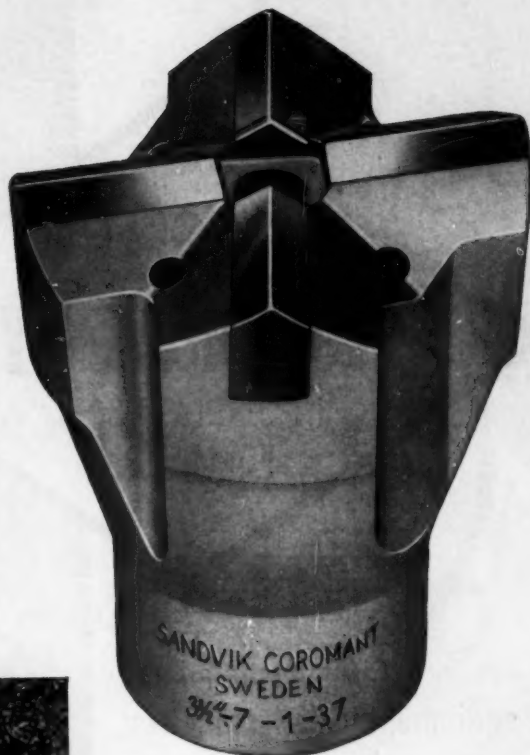
Longer bit life— with *new* Sandvik Coromant Bits



Sandvik Coromant Tungsten Carbide
(Microphoto) Uniformity of size, even distribution of grain are marked. Free from porosity and impurities—therefore stronger, longer-lived.



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(Microphoto) Black marks are contaminations caused by deficient production control. They weaken the carbide, reduce its working life.



Sandvik Coromant Detachable Bits are Available in the following Thread Sizes and Bit Diameters

		Available Diameters, In Inches															
Type	Thread	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/2	4	4 1/2	5	6	8	10	12
SHOULDER	TAPER	x	x	x	x												
	F	x	x	x													
	113		x														
	H		x	x	x	x	x	x									
	115		x	x													
	D					x	x	x	x	x	x	x	x				
BOTTOMING	K										x	x	x	x			
	1" Rope			x	x	x	x	x									
	1 1/4" Rope				x	x	x	x	x								
	400				x	x	x	x									
	1 1/2" Rope								x	x	x	x	x				
	500								x	x	x	x					
	700										x	x					
	17.5													x	x		
	2" Rope													x	x	x	x
	1000															x	

NEXT time you buy bits, specify Sandvik Coromant because they give more footage per bit, lower drilling costs. Here's why:

- 1 Only first-quality tungsten carbide is used—as shown in the microphotos above. This means less wear, longer life and a better job.
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- 3 The bigger Sandvik Coromant bits are all of X-design, which prevents rifling. No wonder Sandvik Coromant inserts are the most widely used in the world, drilling more than one billion feet every year.

SANDVIK COROMANT bits are supplied through Atlas Copco, the world's largest manufacturer of rock drills, who also supply Sandvik Coromant integral steels—the most widely used in the world—and Sandvik Coromant extension steel equipment.

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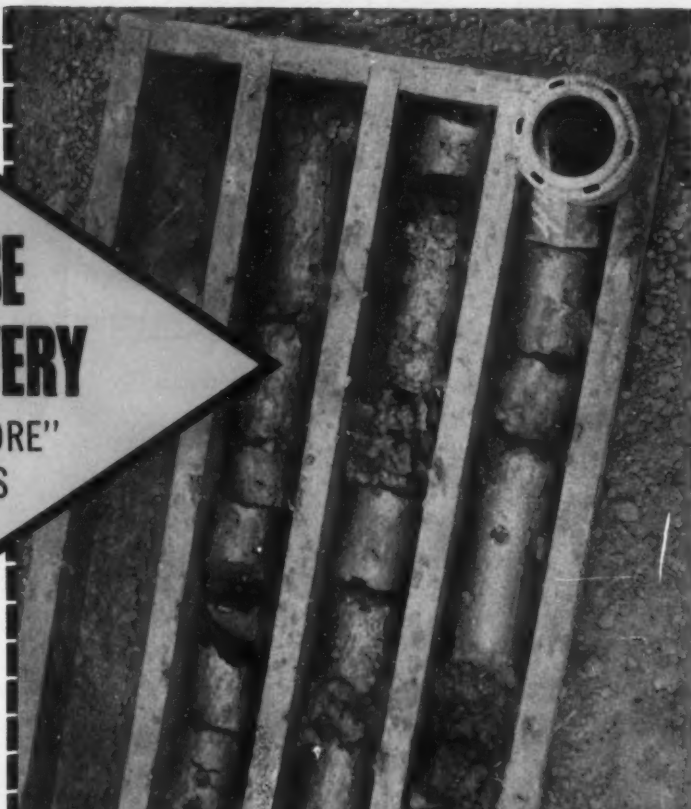
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percentage core recovery

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Every dollar invested in exploration is spent for the sole purpose of evaluating ore reserves. To properly analyze the ground below the rig, the geologist must have "good" cores. Christensen's 4½" x 3", B-3018 barrel delivers best possible cores in soft formations. For more detailed information write Christensen Diamond Products. Specify No. SF-967.

Diamonds Mean, "Less cost per foot."

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Mining World

Including the Export Edition WORLD MINING

Published monthly except in April when publication is semi-monthly

VOLUME 21

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Metallurgy

How Cyanamid Floats Coarse Particles of Florida Phosphate .. 32

By A. E. ROBERTS

Coarse particles in washing plant tailing are floated with fuel oil, crude tall oil, and caustic soda. Concentrate is cleaned by floating away silica particles with Aeromine 3037.

Lucky Mc Uses Moving Bed Ion Exchange at Wyoming Mill 42

By STANLEY DAYTON

This is first uranium mill in United States to use moving ion bed. It has cut capital costs, it saves on reagents, and it is efficient. Instrumentation and control of this modern mill are described in detail.

Why Germans Crush Potash By Impact (Part I) 48

By KURT SCHMIDLAPP

Detailed studies and pilot plant operational data are presented for dry crushing of potash ores to preserve mineral grain structure with dust-free operating conditions.

Tunneling

Utah Construction Drives Bingham Canyon Tunnel

Ahead of Schedule 37

The new 18,000 foot tunnel will permit Kennecott's Utah Division to cut open pit mining costs. Utah Construction set a world record in driving tunnel and will complete it a year ahead of schedule.

Open Pit Stripping

Nchanga Copper Strips Nchanga Pit With Bucket-Wheel Excavator 40

New bucket wheel excavator, 5,500 foot long belt conveyor, and overburden stacker handle more than 1,000 tons per hour at Northern Rhodesian mine.

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Pacific Tin's No. 2 Dredge's First 50 Years 47

By C. M. ROMANOWITZ

This dredge has dug gold in Alaska and tin in Malaya and still leads in some phases of dredge design reports Norman Cleaveland, Pacific Tin's president.

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ON THE COVER

Nchanga Consolidated Copper Mines Limited's new 408 ton bucket-wheel excavator is now stripping overburden at the Nchanga open pit. The belt at bottom of picture carries overburden 5,500 feet to crawler mounted boom stacker on waste dump. Excavator capacity can be varied from 1,234 to 1,836 tons per hour.



MINING WORLD, February, 1959. Volume 21, No. 2. Published monthly except April, when publication is semi-monthly at Emmett St., Bristol, Conn. Executive, advertising and editorial offices, 500 Howard Street, San Francisco 5, California. Subscription in United States, North, Central, and South America, \$4.00 per year; other countries, \$5.00 per year. Entered as second class matter Oct. 10, 1951 at the Post Office at Bristol, Conn., under act of March 3, 1879. Postmaster: please send notice 3579 to MINING WORLD, 500 Howard Street, San Francisco 5, Calif.

FEBRUARY 1959




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Two-Faced Diamonds help us cut your drilling costs

This diamond business sure is different! Here you see a shot of the operation known as "mechanical setting". Of course, the setter is setting the diamonds *by hand*; they *must* be set by hand because no machine yet devised has the ability to set diamonds with the "best face to the work" that gives you the better cutting power, longer cutting life and greater footage that you want.

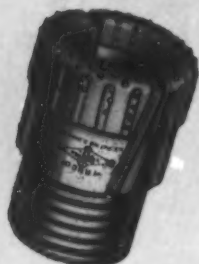
Time was when the setter took the actual bit blank, scribed the pattern, drilled an individual hole for each diamond, set the diamond in, tapped it home, peened in the edges of the hole and, although the technique sounds primitive, turned out a pretty good bit. That was "hand setting".

Nowadays, he starts with a beautiful solid

carbon mold in which the location of each diamond is a precisely spotted cavity. Into each cavity he sets the selected diamond and he still sets it "best face to the work".

This is called "mechanical setting" because it has the advantage of the precise carbon mold. But, for all this modern mechanization, it still has the all-important advantage of an expert eye and a practiced hand placing each diamond as it *must* be placed for top performance.

The Truco Bits resulting from this combination of mechanization, skill and experience demonstrate their superiority in faster cutting, greater footage, higher salvage, lower diamond cost. Try a Truco and see for yourself.



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Published by American Trade Journals, Inc.

Wm. B. Freeman, President

L. K. Smith, Vice President

Miller Freeman, Jr., Sec.-Treas.

WORLD MINING is published the 28th of each month as a regular department of MINING WORLD and is also circulated as a separate publication on a carefully controlled free basis to a selected list of management and supervisory personnel associated with active mining enterprises throughout the world.

SUBSCRIPTION RATES:

U.S., North, South and Central America \$4.00
Other Countries \$5.00
Single Copies \$.50
Directory Number \$1.00

CHANGE OF ADDRESS:

Send subscription orders and changes of address to MINING WORLD, 500 Howard St., San Francisco 5, Calif. Include both old and new addresses and zone numbers.

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MILLER FREEMAN PUBLICATIONS

FEBRUARY 1959

Drifts and Crosscuts

Miners Watch Congress

With the loss of proven Senators with high seniority, with so many new Senators in office, and with the political trend of the new United States Congress to radical changes, the mining industry has a job to do.

Depletion is under attack. Oil is the prime target. For metals and non-metals, the existing rules for processing, the cost of transportation, and percentage allowed are all under fire.

Now is not the time to let Lou or Bob or Harry at your mining association do it all. They are on the job but they need your help. Check with them and do everything you can to help them.

The best way to gain the help of the new Senators is to educate them. The industry must supply material for case histories to show depletion is fair and necessary to keep mines operating. The importance of depletion to finance the search for new mines must be clearly detailed.

Most importantly, the public, editorial writers, and public opinion molders must be supplied factual material that they can understand and use to give the true facts about depletion. The old defense by complicated tax formulas and principles isn't enough now.

Go West in February

Once again the western United States is the capital of the mining world in February. From the Iron Ranges, from the Canadian bush, and right out of western uranium canyons, the prospectors, engineers, miners, geologists, and metallurgists will converge on Denver, Colorado for the National Western Mining Conference. This meeting on February 5, 6, and 7, which is sponsored by the Colorado Mining Association, always draws the top technical speakers who cover completely the latest industry developments.

It's on further west to San Francisco, California for the miners after the Colorado Convention. The City by the Golden Gate, the City that Know's How, and the City miners like to visit will play host to the American Institute of Mining, Metallurgical, and Petroleum Engineers. The AIME annual meeting will be held from February 15 to 19th, and the Sheraton-Palace Hotel will be miners' headquarters.

For those of you who won't be tired out by two conventions, it's back to College. But don't think you will get a chance to sleep in any of the lectures at the University of Arizona's Symposium on the Application of the Fluidizing Reactor. You are advised to bring your slide rule and a copy of *Handbook of Physics and Chemistry*. The Symposium and field trip to Hayden, Arizona will be from February 23 through March 2 at Phoenix. The Hayden trip will be March 3rd.

Go West. There's something for everybody in February.

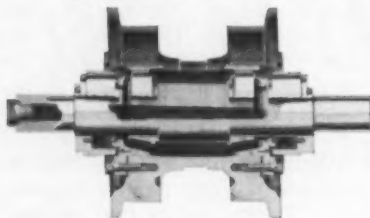


Why waste time
greasing track
on any
of your tractors...
when you can have

Permanent Lubrication **CERTIFIED**



for truck wheels, front idlers and
support rollers on all models of
Allis-Chalmers crawler tractors



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MINING WORLD NEWSLETTER

San Francisco ... Grants ... Washington
February 1959

What will result from the recent U.S. visit of Anastas Mikoyan, the Soviet's shrewdest metal trader?

Miners around the globe won't soon forget his metal dealings of 1958 — temporarily demoralizing the International Tin Agreement; exporting aluminum at less than world prices; and selling platinum at fantastically low rates.

Western miners wonder if he is behind the recent barter of Russian chrome ore for thousands of tons of U.S. rolled steel.

Where will Mikoyan's minerals manipulation be felt next?

The scramble for export markets is on.

U.S. foreign trade, which slumped badly in the first half of 1958, is on the upswing — but so is foreign competition.

Over-all picture for last year wasn't too bad — U.S. businessmen sold \$17,000,000,000 worth of goods in foreign countries and imported \$13,000,000,000 — but it was a hard fight.

Greater currency convertibility will be one aid. U.S. exports were hampered in the past by this lack of convertibility. Now, with 10 European nations removing currency restrictions, we can expand our trade areas.

This means an increased demand for manufactured items — and, eventually, for the mined ore needed to create many of these products.

U.S. lead-zinc quotas will continue through 1959 because they have strengthened metal prices.

Large foreign producers who failed to fill quarterly quotas for period ended December 31, 1958 were: Bolivia for lead ore, Yugoslavia for lead bullion, and Mexico for zinc block.

Some excess foreign lead-zinc products may be absorbed through additional lead-zinc barter arrangements in exchange for U.S. surplus farm products. This could reduce foreign protests on quotas.

This and That:

Increased production to 80 percent of full capacity from the Benson Mines has been authorized by Jones & Laughlin Steel Corp. for its New York iron operation.

Too much local opposition finally forced Kennecott subsidiary, Bear Creek Mining Co., to withdraw its Porcupine Park copper lease application before the Michigan State Conservation Commission.

A new profit-sharing arrangement has been negotiated between Sidney Mining Co. and Nabob Silver-Lead Co. for development of Idaho's Nabob mine.

For only \$10 an acre, U.S. Steel was able to purchase surface rights to 161 acres of Wyoming state land for use in its Atlantic City iron ore project.

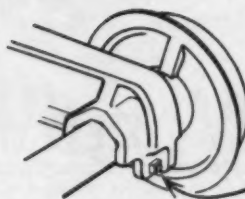
Sinking of one of the deepest shafts in Ambrosia Lake, New Mexico will be started soon by Rio de Oro Uranium Mines, operating for Parador Mining Co.

First casting of molybdenum has been claimed by the U.S. Bureau of Mines.

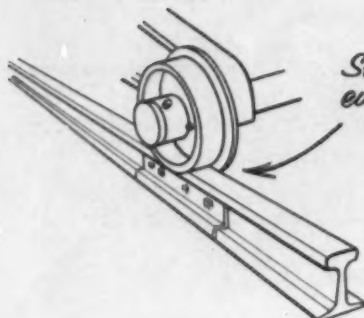
The new 86th Congress already has its first minerals bill from Oklahoma's Pep. Edmondson. Montana's Sen. Murray may seek similar legislation in Senate.



Movement between bolster and side frame is taken on specially designed wear surfaces



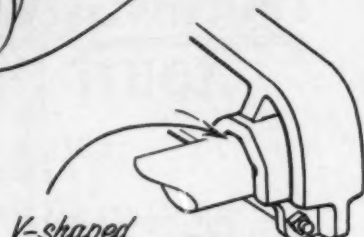
Quick wheel change



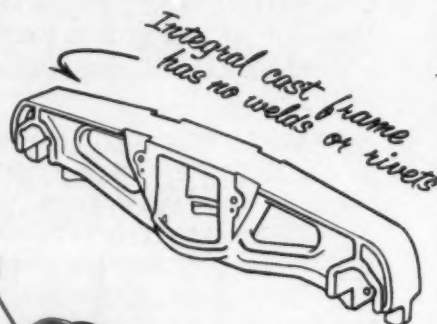
Smoother ride even on rough tracks



Large center bearing for longer life



V-shaped machined axle grips for controlled flexibility and truck alignment



Integral cast frame has no welds or rivets

Check these "plus" features

OF NATIONAL NC-1 TRUCKS

If you're considering the purchase of new 8-wheel mine cars . . . or if you're thinking of modernizing older cars—now is the time to check the advantages of National NC-1 Trucks. National NC-1 Trucks have controlled flexibility for track variations yet still maintain truck alignment through their machined V-shaped axle grips. In addition, NC-1 Trucks have a built-in shock absorbing mechanism.

You get more out of your mine car investment per workshift . . . per day . . . per year. And at the same time you minimize spillage . . . get greater protection for your equipment, track and structures . . . slash maintenance to a new low.

Yes, now is the time to check National NC-1 Trucks—they make sense for 8-wheel mine cars . . . make dollars for operators, too.

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■ RUBBER CUSHIONED UNITS
■ NC-1 CAR TRUCKS • NACO STEEL WHEELS
■ NACO STEEL LINKS & SWIVEL HITCHINGS

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NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY

Established 1868

Cleveland 6, Ohio



Capitol Concentrates

Foreign Manufacturers Ship Semi-Finished Metal Products To Evade Import Quotas

The difficulty of operating a quota system is illustrated by the complaints registered by the manufacturers of lead products. Foreign manufacturers, it seems, are evading the quota on the importation of lead concentrates and metal by shipping in finished and semi-finished lead products on which there is no restriction. Brass-product manufacturers have been up against the same situation when zinc and copper are cheaper abroad and when there are considerable tariff differentials on manufactured and raw materials. For this reason the Brass Research Institute objected to increases in zinc and copper tariffs without commensurate adjustments on manufactured and semi-manufactured products. Any increase in the spread would have automatically accelerated brass imports which already have caused considerable consternation among domestic manufacturers. Either a quota or tariff system must cover the whole field on an equitable basis or some segment of industry will be hurt.

● National Stockpile Contains Huge Surpluses

The time reduction in the stockpile formula from five to three years for a war's duration caused much of the material to be in excess supply. There is said to be nearly \$2,000,000,000 worth of unwanted material that the Office of Civilian and Defense Mobilization would like to dispose of, a great deal of the surplus evidently being in minerals and metals. Some of the materials is in inventory to which the General Services Administration has title and this, presumably, could be sold without special arrangements being made. Such items as have been transferred to the national stockpiles can be released only by the President in case of a national emergency, or with the consent of the Congress otherwise. OCDM would like blanket authority to dispose of stockpile materials, but it seems unlikely that the Congress will grant such authority. At any rate, the Executive policy will not permit disposal where economic disruption would occur, or if the national interests of the United States would be adversely affected. It will be interesting to see how this problem will be resolved.

● OME Regulations Are Issued

The new regulations which will govern federal financial assistance for minerals exploration projects have been released by the Office of Minerals Exploration.

Under the new program, qualified applicants will be offered contracts under which the OME may contribute not more than 50 percent of the total allowable costs in the exploration for some 32 minerals. The government's share in any one contract may not exceed \$250,000. Congress appropriated \$4,000,000 for the program for the fiscal year ending June 30, 1959.

In issuing the regulations, the government responded to industry's objections and reconsidered its proposal to charge compound interest on the government's contribution. The regulations now provide that simple interest, computed annually, shall accrue from the date federal funds are made available. The regulations also call for applicants to furnish evidence that the funds sought for

exploration projects are not available from commercial sources, at reasonable terms. This latter provision was set forth in the law which established the minerals exploration program on a statutory basis.

At the time the OME legislation was enacted, objections were raised to the \$500,000 limitation on any project, of which only 50 percent may be government money. The idea of the Interior Department and the Congress obviously was to prevent large companies with ample exploration funds of their own from entering into million-dollar projects and absorbing the bulk of the appropriations. However, there appears to be nothing in the law to prevent a second or even a third loan to the same company. Actually, the wording of the act (Public Law 85-701) would indicate that the Congress anticipated the possibility of several successive contracts to the same borrower as it says specifically: "No single contract shall authorize government participation in excess of \$250,000." Had it been the intent to limit a borrower to one loan, it would have been easy to express the idea of "one to a customer" in the wording of the law.

It has taken considerable time to get OME rolling, and it will take additional time to determine whether the new agency will operate as well as the Defense Minerals Exploration Administration which it succeeds. However, the new conditions do not seem to be too restrictive, at least on small mine operators.

● Gold Price-Increase Is Predicted

Devaluation of the United States dollar, in terms of gold, is expected "sooner than most people believe" by Philip Cortney, chairman of the United States Council of the International Chamber of Commerce. Cortney made his forecast in addressing the French Academy of Moral and Political Sciences in Paris.

Cortney gave the following reasons for predicting an increase in the officially fixed dollar price of gold: (a) the "demoralized" government bond market despite purchases by commercial banks of nearly \$10,000,000,000 of government securities in the last year; (b) the loss by the United States of \$2,000,000,000 of gold reserves; (c) foreign demand deposits in the United States totaling \$15,000,000,000; and (d) foreign ownership of United States bonds and stocks totaling \$9,000,000,000.

● Ore Grade Shows Steady Decline

According to a study by the Resources for the Future foundation, there has been a comparatively steady decline in the grade of copper ore mined in the United States ever since the Civil War. In the 1860's the grade was probably over 8.0 percent copper. Thereafter it moved downward, reaching 2.0 percent in the first decade of this century, 1.0 percent in the 1940's, and 0.8 percent in the first seven years of the present decade.

One of the speakers at the London metal conference is said to have remarked that nearly all United States mines are now marginal and supplying the United States domestic requirements should be left to foreigners. Strange, (or is it?), but American technology seems to have kept up with the drop in grade and we have some remarkably prosperous copper companies still doing business!

AT SULLIVAN TRAIL

Illustrated is one of two P&H Model 1855 Electric Long Range Draglines—and one of the seven P&H Excavators owned by Sullivan Trail Coal Co., West Pittston, Pa. It is shown stripping anthracite coal near Hazelton, Pa. The P&H 1855 is rated up to 10 cubic yards as either a Long Range Dragline or Stripper Shovel.



COAL COMPANY... *One P&H always
sells another because*
P&H "PROFIT·YDS."
reduce open-pit
stripping costs
all day...every day

Faster swings, higher line speeds, greater line pulls and *maximum* availability all add up to lower cost per yard stripped.

Continuous, high production stripping with P&H Electrics in open-pit mining the world over is the end product of these patented principles:

MAGNETORQUE®... this drive electro-magnetically transmits power from a single A.C. motor to all work motions—drag, hoist, swing and propel. Because of Magnetorque the P&H 1855 swings at speeds unmatched for draglines of such long booms and large buckets.

ELECTRONIC CONTROL... the most responsive electric excavator control, which provides the fastest work cycles known on electric shovels and draglines.

Also, with P&H you get single source responsibility—an exclusive advantage experienced only by users of P&H Electrics. P&H manufactures their own electrical equipment—*designed specifically for electric shovel service*—as well as mechanical equipment.

These patented P&H design principles offer more net profit to users—up to 10% more production, as much as 60% less electrical maintenance expense and downtime reduced as much as one half from that usual to excavators of this size.

P&H

**MINING
EXCAVATORS**

HARNISCHFEGER CORPORATION
Construction & Mining Division
Milwaukee 46, Wisconsin

P&H ELECTRIC SHOVEL LINE: 3½ through 10 cu. yd. capacities





58 NORDBERG GRINDING MILLS in Ore Concentration Plant

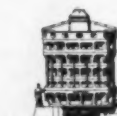
... largest iron ore mill installation under one roof in the world

Here, stretching about a quarter of a mile, are 27 Nordberg Rod Mills and 27 Nordberg Ball Mills in a concentrator building up in the Lake Superior Iron Range of Minnesota. The 54—10 foot diameter Nordberg mills reduce hard, abrasive Taconite Iron Ore to the fineness of flour. Four additional Nordberg mills serve as reserve replacement units.

This is but one example of the way in which Nordberg Grinding Mills, in sizes from 6 to 13 feet in diameter and up to 50 feet in length, are successfully serving the ore, mineral, cement and chemical processing industries of the world.

Years of specialized experience in the design, manufacture and installation of process machinery assure you that you can count on Nordberg, its machinery and "know how" to add efficiency and economy to your processing operations. For complete details, write for the Nordberg Grinding Mill Bulletin 232.

NORDBERG MFG. CO., Milwaukee 1, Wis.



SYMONS PRIMARY
GYRATORY CRUSHERS



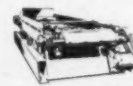
SYMONS
CONE CRUSHERS



NORDBERG
MINE HOISTS



SYMONS GRIZZLIES
and SCREENS



SYMONS
VIBRATING SCREENS



NORDBERG
ENGINES

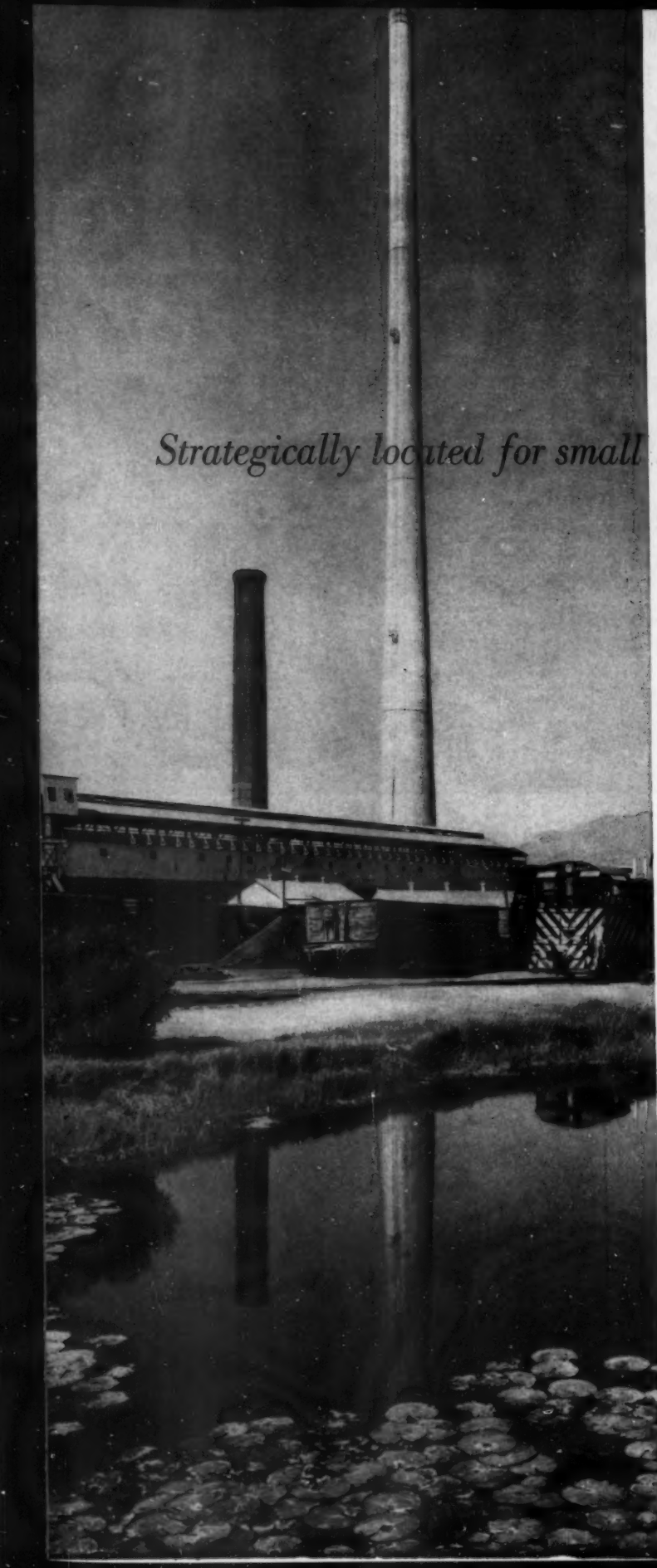


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GM158



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See ASARCO first
buying, smelting, and
refining all types of ores:
GOLD, SILVER, LEAD,
COPPER AND ZINC ores
and concentrates, blister
copper, mattes and residues
22 Smelters and Refineries

Strategically located for small lots or carload quantities...

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Alton, Illinois
East Helena, Montana
El Paso, Texas
Chihuahua, Chih., Mexico
San Luis Potosi, S.L.P., Mexico

ZINC SMELTERS

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Corpus Christi, Texas
Rosita, Coah., Mexico

COPPER SMELTERS

Hayden, Arizona
El Paso, Texas
Tacoma, Washington
San Luis Potosi, S.L.P., Mexico

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Selby, California
Omaha, Nebraska
Perth Amboy, New Jersey
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Baltimore, Maryland
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Tacoma, Washington

See management
at above locations
or write to main office.
American Smelting and
Refining Company,
Ore Purchasing Department,
120 Broadway,
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58-54

ASARCO



PROJECT PAYDIRT *pays off for you*

NEW CAT D8

PUSHLOADING: PRODUCTION UP



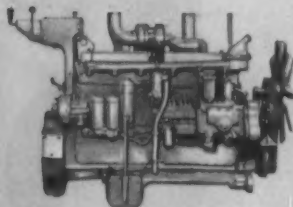
The new Caterpillar D8 Series H Tractor is ready *now* to increase its lead as undisputed king of its size class. A major achievement in Caterpillar's all-out research program, "Project Paydirt" (see box), the new D8 has been proved through a rigorous field testing program.

This D8 is new in design, appearance and performance. It is bigger, more powerful. It incorporates new engineering advances. It is easier to operate.

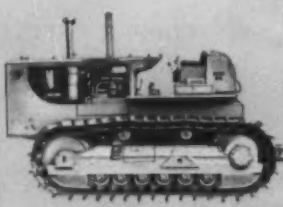
Now—what can it do for you? Here's the answer:

The D8 has been thoroughly field tested on actual jobs. Several of the big new tractors have been at work constantly in every kind of material. Out of the statistics developed, both pushloading and bulldozing production figures are *up*.

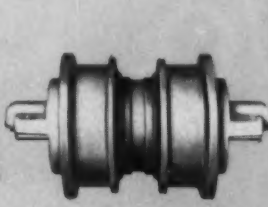
This means that you can move dirt faster and cheaper than ever before with a tractor in this size class. You



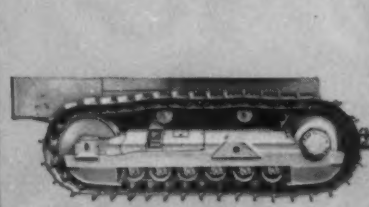
HORSEPOWER INCREASED 18%. The horsepower of the new D8 is up from 191 to 225 at the flywheel, from 155 to 180 at the drawbar. In addition, engine torque rise now is 20%, an increase of one-third. Over-all engine performance has been greatly improved by the addition of a turbocharger.



SIZE INCREASED. To make effective use of the new horsepower, over-all weight of the tractor has been increased 4,400 lb. to a total of 47,000 lb. At the same time the gauge has been increased to 84 inches, track on ground lengthened to 114 inches, square inches of contact increased to 5,505.



LIFETIME LUBRICATED ROLLERS AND IDLERS. That's right—lifetime! In a major research breakthrough, Caterpillar has achieved track and carrier rollers and idlers that never require further lubrication until rebuilding. And service life is hundreds of hours longer than with ordinary rollers.



NEW, STRONGER, HEAVIER UNDERCARRIAGE. Every component, such as frames, links, braces, pins, bushings, shoes, has been made stronger by the use of improved materials and heat treat processes to provide longer life. And ground clearance has been increased 50% to almost 20 inches.

SERIES H TRACTOR

BULLDOZING: PRODUCTION UP



get higher production, bigger profits—yet the new D8 is actually *more economical* to own and operate!

But find out for yourself. Get the full story from your Caterpillar Dealer, all the eye-opening facts and figures that can only be touched on briefly here. Then see this great new machine at work on your operation as soon as possible. You can't afford not to!

Caterpillar Tractor Co., San Francisco, Calif.; Peoria, Ill., U.S.A.

CATERPILLAR

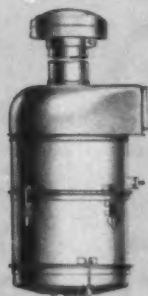
Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

**BORN IN RESEARCH...
TESTED IN THE FIELD**

TWO MORE IMPORTANT OPERATOR CONVENIENCES

HIGHER SPEED. Completely new, long-life, direct drive transmission provides six speeds forward and six reverse. High speed has been increased to 6.3 MPH forward, 6.4 reverse to reduce cycle time. Operator can shift from any forward gear into a similar reverse gear (or vice versa) by simply moving the forward-reverse lever.

DEPENDABLE OIL CLUTCH. By contractor and operator demands, the virtually service-free, easy-to-operate oil clutch has been retained in the new D8. Another important Caterpillar exclusive.



DRY-TYPE AIR CLEANER. Here's still another major Caterpillar research development on the new D8—the new dry-type cleaner which removes 99.8% of dirt in the intake air, even under severe operating conditions. The new cleaner can be serviced in 5 minutes, costs a good deal less to use.

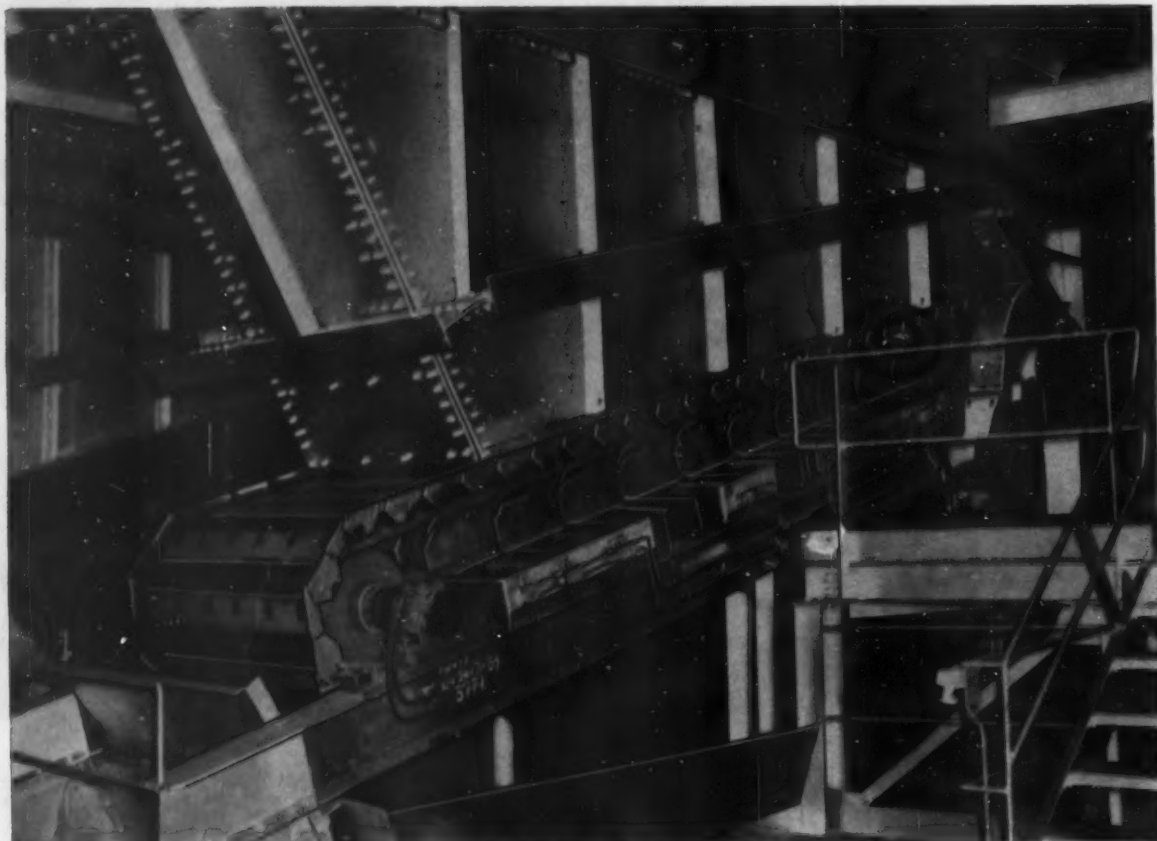


SUPERIOR OPERATION. Operator visibility is excellent because of higher deck and changed seat position. Console-type controls make operator's job easier. And on torque converter models, standard foot-operated decelerator can override hand throttle—free operator's hands for other controls.



PROJECT PAYDIRT: Caterpillar's multi-million-dollar research program—to meet the coming challenge of the greatest construction era in history with the highest production earth-moving machines ever developed.

STEPHENS-ADAMSON



FEEDERS FOR BIG TONNAGE CONTROL AT LOWEST OPERATING COST!

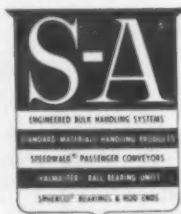
The experience of STEPHENS-ADAMSON engineers in the design and construction of Feeders and Apron Conveyors extends from the handling of Potash at Carlsbad, New Mexico to the gold mines of Africa, from the nitrate and copper mines of Chile to the giant Seven Islands iron ore range in Canada. From light duty units to giant AMSCO Feeders built to take the impact delivered by thousands of tons of run of mine, ore and stone, S-A engineers have a world of "know-how" in the design of efficient, profitable Feeders. STEPHENS-ADAMSON engineers will be happy to work with you on any bulk materials handling problem.



AMSCO Manganese Steel Pan Feeders handling copper ore at a Southwestern mine.



WRITE FOR
BULLETIN 255



ENGINEERING DIVISION

STEPHENS-ADAMSON MFG. CO.

GENERAL OFFICE & MAIN PLANT, 13 RIDGEWAY AVENUE, AURORA, ILLINOIS

PLANTS LOCATED IN: LOS ANGELES, CALIFORNIA • CLARKSDALE, MISSISSIPPI
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CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"



AEROFLOC® 550 Reagent now available in 20% solution form

Widely accepted as an effective, economical flocculating agent for finely-divided solid suspensions, AEROFLOC 550 Reagent in solution form is easier to use and often more economical than flake material due to lower handling and labor costs in the mill.

Stock solutions are quickly made up by pouring the 20% solution form of AEROFLOC 550 into a mixing tank and diluting to the desired 0.1% to 1.0% strength before feeding to the pulp or slurry to be treated.

AEROFLOC 550 Reagent solution is attractively priced. Ask our nearest office to send you a sample for test with complete instructions for use.

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AMERICAN CYANAMID COMPANY

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CYANAMID INTERNATIONAL — Mining Chemicals Department
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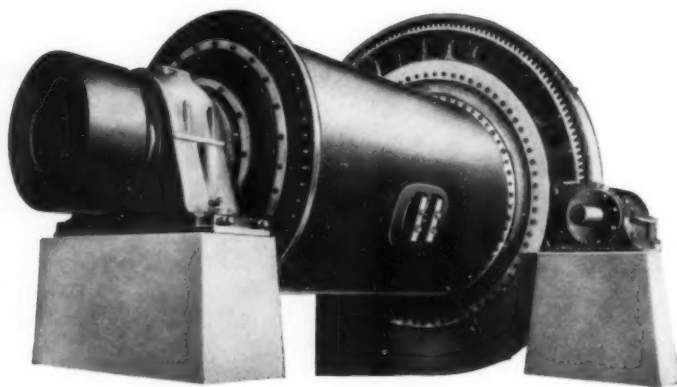
**rugged
dependable
ball mills**

**Traylor made for
greater profit**



Traylor Ball Mills are made in two types—overflow and diaphragm discharge. They are built for either wet or dry grinding.

Traylor Ball Mills feature shell liners of manganese or high carbon steel in plain, wave, cascade, lifter or Lorain types with shells of welded steel construction. Trunions are cast integrally with the detachable heads. Main bearings are made of Meehanite* metal, larger sizes fitted with a high-pressure Alemite pump. Driving gears are steel, precision-cut on our Maag gear generator. Write for Bulletin No. 11-121 today!



Traylor Grinding Mills are available in Ball, Rod, Compartment and Tube Mills.



ENGINEERING & MFG. CO.

1122 MILL ST., ALLENTOWN, PA.

Sales Offices: New York — Chicago — San Francisco
Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.



Adverse haul conditions reducing your output?

Put your hauling operation on a high-production basis — despite restricted areas, rough winding roads, or bad weather conditions — with rugged LeTourneau-Westinghouse Tournapull® Rear-Dumps. Here's how these pivot-steer haulers can cut minutes off your haul cycles.

Speeds loading — Because the Tournapull prime-mover pivots 90° right or left, you can place L-W Rear-Dumps under the shovel *quick*. Low, wide bowl-opening gives shovel operator big, easy target... cuts spillage. Production delay for clean-up of pit-floor is minimized. Three-layer, all-steel bowl floor withstands pounding of heavy rocks. Sloping sides deflect load shock, cushion floor area with layer of material.

Hauls anywhere — Equipped with exclusive power-transfer differential, L-W Rear-Dump keeps load moving steadily through mud and slippery footing, over uneven ground, and around sharp turns. Big, low-pressure tires give top flotation — low center of gravity assures stability on uneven terrain.

Dumps quick, clean — Flick of switch on control panel instantly activates point-of-action electric hoist-motor. Body raises quickly, to

desired angle. At full-dump position, edge of bowl is low behind rear wheels. Material dumps clean. It cannot roll forward to lodge against wheels, nor pile under rear end. Streamlined body sheds stickiest material readily.

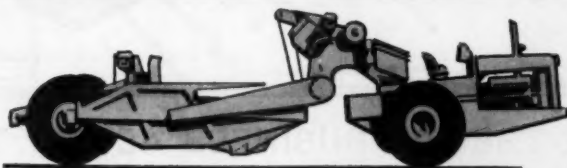
Safe, effortless control — Both dumping and steering are actuated by a quick, simple fingertip movement on electric switches. Giant air brakes — combined with Electrotarder, for auxiliary non-wear fly-wheel brake power — add safety.

Maintenance is low, because highly-simplified L-W Rear-Dumps eliminate so many vulnerable parts that cause trouble on conventional haulers. All-welded, reinforced steel bowl resists toughest wear and shock.

Ask for information

We shall be pleased to send you complete data on the LeTourneau-Westinghouse Rear-Dump. Compare its time-saving performance against your present haulers. Select from 3 sizes: 11, 22, and 35 tons.

Tournapull—Trademark Reg. U.S. Pat. Off. R-1862-MQ-1



Converts to easy-loading scraper

When rock-hauling work is completed, you can interchange the L-W Rear-Dump trail-unit with an easy-loading scraper, behind the basic Tournapull prime-mover. You'll then have a double-duty tool for stripping and roadbuilding — or to rent out profitably for all types of earthmoving projects. Scraper is available for about 1/4 the cost of complete original L-W Rear-Dump. Other specialized trail-units to increase prime-mover's usefulness also available.



LETourneau-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

MEMO
TO MEN
ON THE
MOVE:



WHERE THERE'S BUSINESS ACTION THERE'S A BUSINESSPAPER

In any kind of racing—man, beast, or automotive—the “inside track” is the favored position.

Same holds true in the business race. But here the “inside track” means having more information—sounder information, more complete information, more timely information.

The astute businessman—the man on top and the man on the way up—gets that information from the businesspaper he subscribes to in his particular field. He reads for profit, not for pleasure. He searches for facts he needs to make decisions. For fresh ideas. For new methods. For new products he can put to work. He reads, in short, to get the “inside track” against competition.

And he finds much of what he wants and needs in the advertisements in his businesspaper. So, logically, he reads the advertising with the same scrutinizing care he devotes to the editorial pages.

Take a tip from the man on the move who wants to keep his job and his business *moving*—on the “inside track.” Subscribe to your businesspaper. Read every issue. Carefully. Thoroughly. Searchingly.

MINING WORLD



A MILLER FREEMAN PUBLICATION



"D" hauls overburden 177 m (580 ft) in an average of 16 seconds. Before coming here the three "D's" worked at two other opencast mines in Shipley and leveled land for the Hope Valley School in Derbyshire. Machines demonstrated their mobility by driving from job to job, as they covered a 4-kilometer (2½-mile) distance from coal site to mine in 10 minutes.



IN ENGLAND

How mined land is recovered for farm use

1,146,000 m³ overburden excavated, later replaced

Opencast mining contracts with the British National Coal Board always include provision for restoration of the mined land for agricultural uses.

Under such a contract, W. J. Simms Sons & Cooke Ltd., Public Works Contractors, Nottingham, mined the Plantation Opencast Coal Site at Shipley, Derbyshire, in a four-stage operation: 1. stripped topsoil and subsoil, and hauled to dumps. 2. excavated overburden with dragline and Tournapulls and mined out the coal. 3. replaced overburden to suitable contours. 4. replaced subsoil and topsoil to leave site suitable for farming. A total of 1,146,000 m³ (1,500,000 yd³) of coal, shale, rock and clay was moved.

D Tournapulls strip, and replace topsoil and subsoil

To handle stripping and restoration work, the contractor brought in three LeTourneau-Westinghouse D Tournapulls with 6.8-m³ (9-yd³) scrapers.

In some areas, the fleet removed as much as 7.6 m (25 ft) of overburden to reach the first coal seam. Coal veins themselves measured 2'6" and 8'0" including partings.

In the section of the pit where these photographs were taken, D Tournapulls stripped away 30½ cm (12") of topsoil, then 30½ cm (12") of subsoil, and finally 61 cm (24") of rock and bind-free matter, to expose the coal deposits.

"D's" hauled the excavated material into a mined-out portion of the pit, and spread it in reverse order, first overburden, then subsoil and topsoil. Loads averaged 6.1 m³ (8 yd³).

Likes speed, mobility, production

Mr. Harold Smith, Opencast Executive for W. J. Simms Sons & Cooke Ltd., and Superintendent A. E. Beer, are pleased with Tournapulls' "speed, mobility, production per hour, and good operation in confined spaces.

"Tournapulls have helped to keep contracts ahead of schedule. Output per hour has exceeded expectations."

Maintenance men on the project note that lubricating Tournapulls is easy, because lubrication and maintenance points are accessible.

Ask for more information

D Tournapulls' fast work and travel speeds, up to 47.4 kph (29.5 mph), are a big factor in their high production on all types of earthmoving. Their speed and mobility will reduce your stripping costs and increase production, too. Write us for full details on these machines.



Uncovering coal deposits at Plantation Opencast Coal Site at Shipley, Derbyshire, this D Tournapull is pushed approximately 6 m (20 ft), to load 6.1 m³ (8 yd³) of shale and clay. Loading takes about 11 seconds, depending on class of material says Harold Smith.

Tournapull—Trademark Reg. U.S. Pat. Off. DP-1991-DCJ-1m

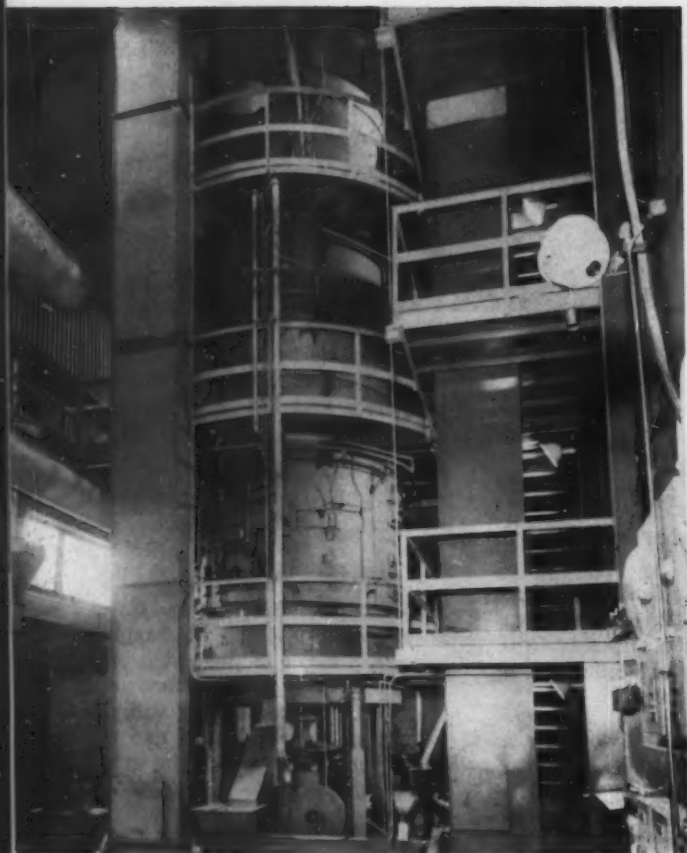


LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

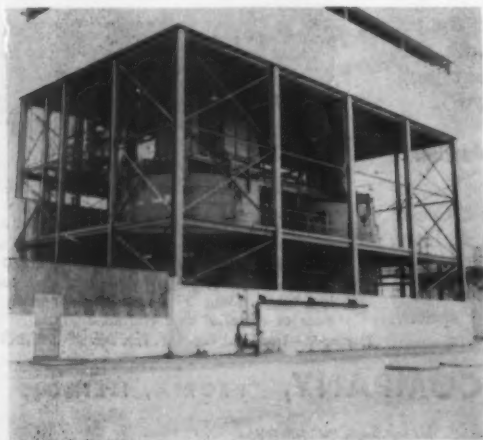
A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

Skinner Furnaces



8' I.D., 8 Hearth Skinner Furnace roasting molybdenum concentrates.



Two 23'6" I. D., 4 Hearth Skinner Furnaces drying over 40 tons of copper sulphide concentrates per hour.

Important Advantages

Flexibility. A wide range of possible combinations of diameter, number of hearths, number of burners, gas offtakes, up or down draft, rate of feed, retention time, etc., permit engineering a Skinner Furnace to the exact requirements of each individual application.

Minimum Dust Losses.

Will Handle Sticky Material.

Accessibility. All wearing parts may be replaced without cleaning out or cooling down the furnace.

Visibility. Access doors permit view and accessibility of material at each hearth.

Small Space. Minimum floor space per ton capacity.

2 to 14 Hearths.

4'0" to 23'6" Inside Diameter.

22 to 4000 sq. ft. Hearth Area.

Gas, Oil or Coal Fired.

**Proved and Improved
for 38 years**

Licensed Manufacturers and Sales Agents in Canada, Australia, Sweden, England and South Africa.

Sales Agents in Chile, Peru, Philippine Islands, Japan, New York City (for Continental Europe), and in the principal cities of the United States.

..for Drying, Roasting, Calcining, Incinerating and Decomposing

Applications

Roasting Molybdenum Sulphide Concentrates. The Skinner is of particular value here, where critical and very accurate control is essential to produce the desired product.

Roasting Uranium-Vanadium Ores. The Skinner is being widely used on the Colorado Plateau and in foreign countries for salt roasting uranium-vanadium ores at rates as high as 200 tons per day, per machine. Organics are also removed during this process.

Drying Uranium-Oxide Precipitate. The Skinner has been accepted as the standard unit for drying uranium oxide precipitate. Skinners operating in this field are handling from 1000 to 30,000 pounds per day, per machine, on feed containing 50 to 80% moisture. Of particular advantage in this application is the possibility of "up-grading" the product.

Decomposition of Oil Sludge. The advantage of the Skinner in recovering acid from oil sludge has been in its ease of control and higher capacities, compared with other type units.

Lime Burning. In lime burning the Skinner's ease of control and fast slaking product, with maximum CaO product, is of distinct advantage in beet sugar refining.

Drying Copper Concentrates. A relatively recent application is in drying copper concentrates at critical maximum temperatures to control moisture content ahead of smelting operations. Capacities up to 600 tons per day, per machine.

Roasting Zinc Ores. One of the widest applications is for roasting zinc ores. A typical installation reports, after 25 years of continuous service, original refractory still being utilized. Conventional or flash roasting is available.

Manganese Reduction.

Dehydration of Alunite.

Calcining of Basic Alum for production of 99% alumina.

Calcining of lime sludges, clays, foundry sand, carbon, etc.

Incineration of sewage, either as garbage or digested sludge.

Operation and Construction

The Skinner is the multiple hearth type furnace. It consists of a series of refractory hearths superimposed one above the other and separated and supported by a cylindrical refractory wall. This assembly is built upon and supported by a steel framework and shell.

A central, vertical shaft rotates horizontal arms, equipped with rabble teeth, for each hearth. Material is fed to the top hearth. The rabble teeth stir and convey the material to "drop" holes where it falls to the hearth below.

Burners generally operate through openings in the shell, the number of burners and their location are determined to meet the specific requirements of each individual installation.

Manufacturing Division

THE MINE AND SMELTER SUPPLY CO.

DENVER 16
3800 RACE STREET

NEW YORK 17
122 E. 42nd STREET

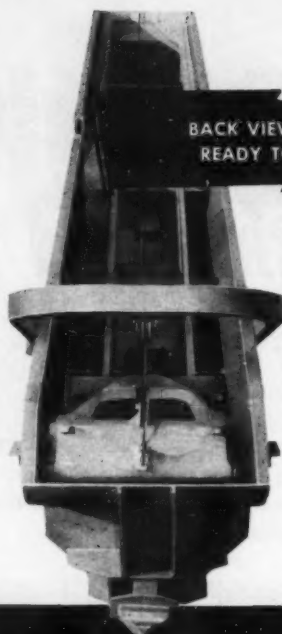
SALT LAKE CITY 1
121 W. 2nd S.

EL PASO
P.O. BOX 1162



BACK VIEW SCRAPER READY
TO MAKE DOWN-STROKE

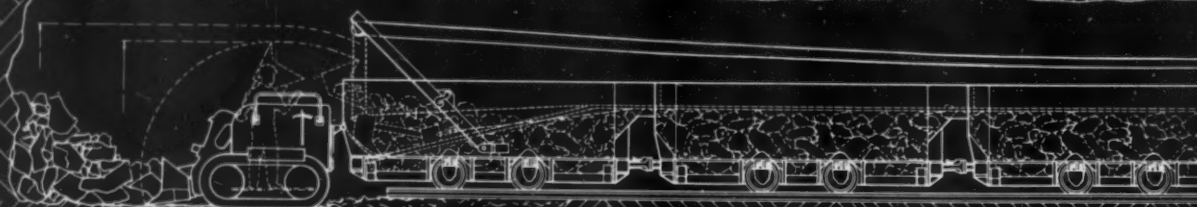
- **NO CAR SWITCHING!** S-D Slusher-Train's self-contained scraper loads each car progressively in-train!
- **NON-STOP DUMPING** of entire trip because S-D Automatic Bottom Dumping Cars in S-D Slusher-Train dump one-after-another while moving over bin or dump.



BACK VIEW SCRAPER
READY TO SLUSH-OUT

- After drift work is completed, S-D Slusher-Train can be converted to regular production work . . . and you have Sanford-Day's exclusive "Overlapping Ends," making it possible to load without spillage between-cars when loading under chutes or conveyors into one car, then another!

WHY S-D SLUSHER-TRAIN PROMISES YOU



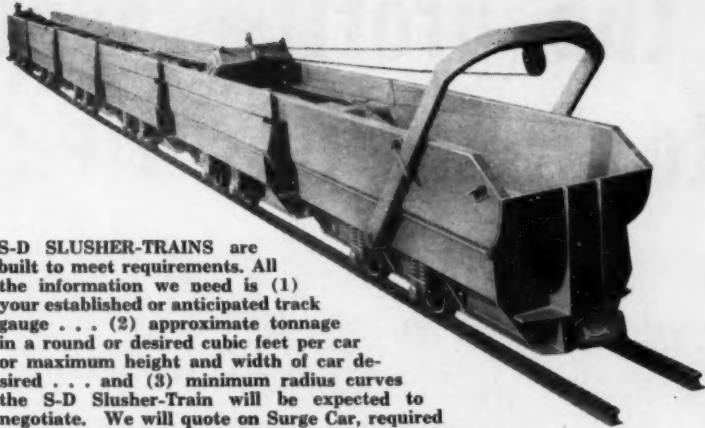
FRONT VIEW SCRAPER READY
TO MAKE DOWN-STROKE

- **MINIMUM EQUIPMENT** — only a loader, S-D Slusher-Train and a locomotive!
- **MINIMUM MANPOWER** — two men only . . . loader operator and S-D Slusher-Train operator (who is motorman when train is in transit).



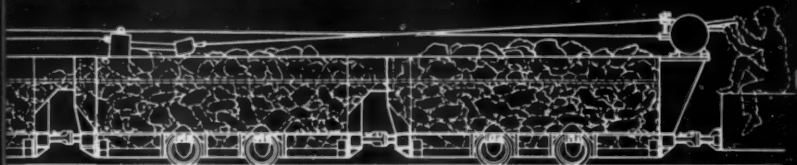
FRONT VIEW SCRAPER
READY TO SLUSH-OUT

- **HIGH SPEED** — There is no method that can match the S-D Slusher-Train in speed (you can easily figure on mucking out 1 to 1½ tons a minute). The "high-ball-it" speed and safety will save you days . . . perhaps weeks in completing drift or tunnel work! This means minimum cost!

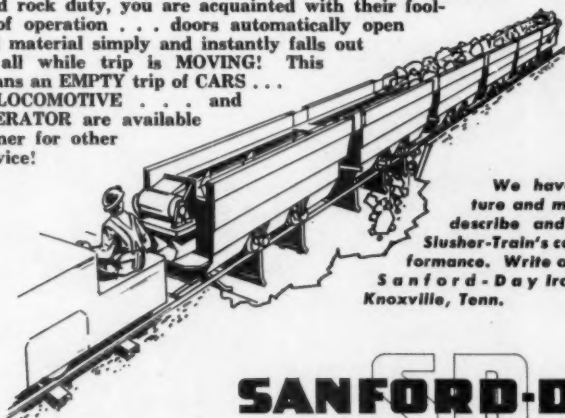


S-D SLUSHER-TRAINS are built to meet requirements. All the information we need is (1) your established or anticipated track gauge . . . (2) approximate tonnage in a round or desired cubic feet per car or maximum height and width of car desired . . . and (3) minimum radius curves the S-D Slusher-Train will be expected to negotiate. We will quote on Surge Car, required number of middle cars, and the Hoist Car, complete with slusher hoist, scraper and recommended rope.

TREMENDOUS SAVINGS!



The bulk of your cost savings will undoubtedly be earned in the **MINIMUM TIME** S-D Slusher-Train requires to load-out a round, which is due to more efficient use of equipment and manpower. Add to this **MINIMUM DUMPING TIME!** If you have seen S-D Automatic Bottom Dumping Cars perform in the toughest hard rock duty, you are acquainted with their fool-proof operation . . . doors automatically open and material simply and instantly falls out — all while trip is **MOVING!** This means an **EMPTY** trip of CARS . . . a **LOCOMOTIVE** . . . and **OPERATOR** are available sooner for other service!



We have both literature and movies that will describe and show S-D Slusher-Train's cost-saving performance. Write or call us today. **Sanford-Day Iron Works, Inc., Knoxville, Tenn.**

SANFORD-DAY
KNOXVILLE, TENNESSEE

These are the profit-proven that lead to Payhauler® fleet

Look into the rock-lugging, grade-beating 24-ton "95"...

- Bonus-powered, with a 335 hp high-torque turbo charged diesel engine to beat steep grades and high altitudes with full payloads!
- Your choice of torque converter with powershift, or 9-speed constant mesh transmission. Speeds to match every load and road.
- Shock-cushioning of planetary drive axles.
- Massive frame stamina—with 277 lbs. of high-strength, shock-resisting steel for each rated ton of carrying capacity.
- Springs with extra leaves and extra length to cushion the payload, smooth the ride.
- Positive power-steering, Torqmatic braking, panoramic vision, for unmatched operating ease and load-speeding safety.
- Up to 25% higher hauling speeds—the "95" can high-ball, fully loaded, up to 38 mph.
- Faster reverse speeds—for spotting to load, or positioning full loads for dumping. The gear-drive "95" can travel up to 7.1 mph. in reverse.
- 9-second dumping—another cycle-speeding feature.

...and the 250-hp, 13-ton "65" has equally outstanding features.



International Construction Equipment

International Harvester Co.
180 North Michigan Ave., Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers and Bottom Dump Wagons... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.

Power for steep grade climb-outs wins steady job for five "65's"

Bonus Turbo Charged Diesel power to deliver extra-tonnage loads up a haul road with a 17% average grade accounts for the dependence of Caldwell Engineers on five "65" Payhaulers—on the \$13 million hydro and flood-control Oliver Dam, Columbus, Ga.

Contractor doubles load delivery speed with positive Torqmatic braking!

Central Pennsylvania Quarry and Stripping Co. credits Torqmatic braking of their 5-unit "95" Payhauler fleet with doubling load delivery speed—by increasing safe downhill hauling speeds! They've compared "95's" directly to other off-road equipment on rock-hauling duty!



features ownership!

Prove what it means to command the Payhauler ratio of power to payload—for hauling up to 25% faster; beating grades and altitude. Try Payhauler "pick-up-truck" spotting ease—"zip-around" power steering—exclusive high reverse—and all the other Payhauler advantages. See your International Construction Equipment Distributor for a demonstration!

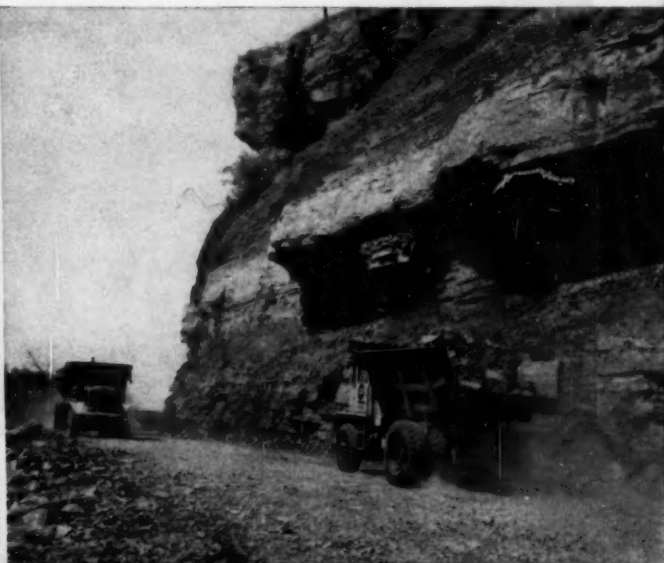


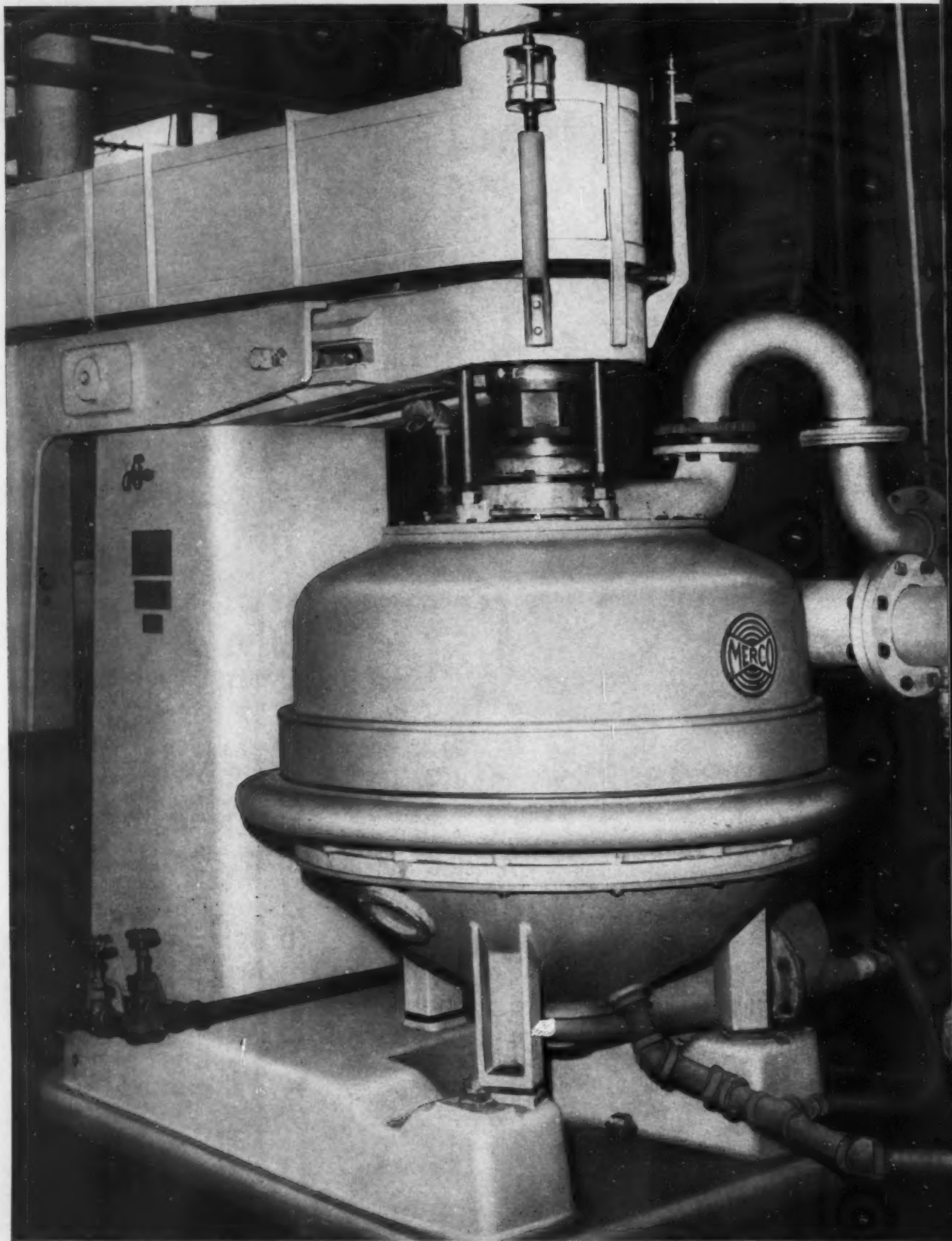
High-percentage availability proves inbuilt stand-up-ability!

98.5 work availability through one measured 12-week period is the mark set by a 10-unit "95" Payhauler fleet—high-balling rock over steep High Sierra grades, on mammoth Pool Hydro Project, for Southern California Edison Co. Such records result from reserve power, reserve frame and transmission strength, and reserve shock-resistance!

Another thirty "95" Payhaulers join Merritt-Chapman and Scott fleet!

Merritt-Chapman and Scott Corporation has added thirty more "95" Payhaulers to their Niagara Power project equipment spread. Now, the M-C and S Payhauler fleet totals 62 units—largest in the world! On St. Lawrence Seaway, huge Glen Canyon dam, and Niagara Power Project, M-C and S have proved rock-lugging, grade-beating Payhauler performance—and confirmed their satisfaction with repeat orders.





New H-30 Merco Centrifuge, with increased speed and capacity, in operation at Argo, Ill. plant of Corn Products Refining Co.

NOW...

increased capacity in
NEW MERCO CENTRIFUGE
for nozzle bowl applications

Rotor speeds up to 3300 rpm and capacities up to 600 gpm are now possible with the new, improved H-30 Merco Centrifuge. At the same time, power requirements per gallon of feed have been substantially reduced.

In the first two installations, this new unit produced comparable removals at nearly double the capacity of previous models . . . and showed *no increases* in total power consumption.

This new operating efficiency is a result of improvements in rotor design, which provides greater disc area. Feed passages have been enlarged to accommodate increased flow.

The new Merco H-30 Centrifuge is particularly useful for clarification and thickening of slurries which contain fine solids (0.5 micron) over a wide range of feed solids concentrations (.02% and up). It is now available with a 30" stainless steel rotor

and bronze or stainless steel housing. In addition to its new large capacity and higher speeds, it contains these standard Merco benefits:

- The unique return flow principle that permits concentrating, washing, clarifying, classifying and recovery of soluble values at pressures up to 150 psi.
- No nozzle clogging or solids build-up in the unit.
- Overhead drive eliminates need for submerged bearing.
- Hydraulic hoist is built in to simplify inspection and maintenance.

If yours is a process that needs a large capacity centrifuge, there is a place for the Merco H-30 in your plant. For further information, write to Dorr-Oliver Incorporated, Stamford, Connecticut.

Merco—Reg. T.M. Pat. Offl.



"Not merely to sell; but to serve . . . not only to make good steel products; but to make them still better . . . not only to fulfill today's requirements; but to anticipate tomorrow's—these are the principles that constantly guide CF&I."



Grinding Mill Bulletin #4

G. F. Franz
President

In line with our company policy—service as well as sales—CF&I is presenting this series of ads on grinding ball rationing in the makeup charge. We trust that these ads will help grinding mill operators—by providing information that will help increase the efficiency and productive capacity of their ball mills.

General Method of Rationing the Makeup Charge

These facts have been outlined in previous ads in this series: (1) that determining the optimum size assortment of grinding balls for a makeup charge is a practical means of improving mill operation; (2) that the best makeup charge of one-size ball should be established before a rationed makeup charge is attempted; (3) that over-size ball additions are preferable to under-size additions in general, although both reduce mill efficiency; (4) that radical changes in the size of the balls to be added is not good practice. Now let us look at methods that are regarded as good practice.

If it is determined that there is a shortage of small balls in the seasoned charge, part of the makeup charge may be made up by smaller balls of one or more sizes. If there is a problem of tramp oversize in the grinding circuit, a portion of the makeup charge may be replaced by a ball of larger diameter.

In many cement plants, the seasoned charge in the mill contains too many balls that have worn to small and irregular shapes—so that they give ineffective contact. These small and "cull" balls take up space that could be better utilized by larger spherical balls which would grind more effectively. In order to increase the ratio of larger balls in the charge, the mills are periodically dumped; the charge screened; the larger balls returned to the mill; and new balls are added to make up for those cull balls which are removed.

Steps In Working Out The Ball Ration

Complete records should be kept:

- (1) so that the throughput of the mill, ball wear and power consumption are known. It is also well to record liner wear, although this requires observation over a long period of time.
- (2) of feed, discharge, classifier overflow, and classifier sands screen analyses. Classifier sands size structure will give indications as to whether smaller or larger balls in the charge will give better results.
- (3) to show the effect of any change in ball addition on: the mill throughput, power consumption per ton and ball wear in pounds per ton. These changes will affect the size structure of the mill discharge as well as the classifier overflow and sands.

Before it is assumed that the full effects of a change in ball additions have occurred, the ball wear pattern should be given time to reach its new equilibrium. This will

involve the amount of time required for the old ball charge to be entirely replaced by the new charge. For example, if the ball load in the mill is to be maintained at 100,000 lbs., and 1000 lbs. of balls are added per day to maintain that ball level, it is reasonable to assume that more than three months will be needed in which to complete the modified ball charge.

If the new makeup charge is one that would increase the rate of comminution of the ball mill, and if the new ball charge reaches its equilibrium *without* an increase in feed rate: the new charge will *not* show an increase in throughput; the steel consumption will be too high—due to steel on steel wear; and steel consumption per ton of ore ground will be unnecessarily high. Therefore, to prove the value of a change in ball ration, it is important that care be exercised to keep the mill feed at capacity at all times.

Rules, studies and formulae for analyzing classifier sands data, mill feed or dumped ball charges, are discussed in the article on which this ad is based.* Too much space would be required to cover this material here. However, CF&I's mining department engineers are thoroughly familiar with good practices in grinding ball operations, and are ready to help you with your specific problems. CF&I is also ready to provide special analysis steel grinding balls which will give you maximum production efficiency in your grinding mill. CF&I Grinding Balls are available in all standard diameters from $\frac{3}{4}$ " to 5". They are carefully inspected throughout production and immediately prior to shipment to ensure that they are free from surface pits, circumferential ridges or other surface defects. You'll find them ideally suited to helping you work out the correct ball ration for your specific operations.

**For a reprint of the article on which this series is based, please write on your company letterhead to: Mining Supply Department, The Colorado Fuel and Iron Corporation, P. O. Box 1920, Denver, Colorado.*

OTHER CF&I STEEL PRODUCTS FOR THE MINING INDUSTRY

CF&I Grinding Rods • CF&I Grader Blades • CF&I Industrial Screens
CF&I Mine Rail and Accessories • Wickwire Rope • CF&I Rock Bolts



FORGED STEEL GRINDING BALLS
THE COLORADO FUEL AND IRON CORPORATION

Albuquerque • Amarillo • Atlanta • Billings • Boise • Boston • Buffalo • Butte • Chicago • Denver • Detroit • El Paso • Ft. Worth • Houston
Kansas City • Lincoln • Los Angeles • New Orleans • New York • Oakland • Oklahoma City • Philadelphia • Phoenix • Portland • Pueblo
Salt Lake City • San Francisco • San Leandro • Seattle • Spokane • Wichita

6120

Mining World

THE IMPORTANT MINING MAGAZINE EVERYWHERE

February 1959

INTERNATIONAL PANORAMA

ISHPEMING, MICHIGAN—The Humboldt Mining Company is doubling capacity of its iron ore (jaspellite) flotation plant here and building a new pelletizing plant. First pellets will be produced in 1960 at an annual rate of 640,000 tons.

MOAB, UTAH—Potash deposits have been discovered southwest of the Lisbon fault by Superior Oil Company of California. The Big Indian uranium district is located on northwest side of fault.

KITWE, NORTHERN RHODESIA—Bancroft Mines Limited plans to reopen its underground copper mine April 1st and reach an annual copper output of 55,000 short tons by year's end.

SILVER BAY, MINNESOTA—Shipments of iron ore and taconite pellets on the Great Lakes in 1958 were 52,868,028 gross tons. In 1957 shipments were 84,615,871 gross tons. Taconite pellet shipments were over 8,500,000 tons; highest in history.

MOJAVE, CALIFORNIA—Sunray Mid-Continent Oil Company has geologists and drillers searching for minerals in a 75,000-acre area of the Mojave desert.

COCHENOUR, ONTARIO—High-grade gold ore has been discovered by underground diamond drilling at Cochenour Willans Gold Mines Ltd. A 14-foot-wide core assayed over 200 ounces gold per ton; sludge from hole was higher grade.

JEFFERSON CITY, TENNESSEE—New Jersey Zinc Company has placed its new Treadway zinc mine and mill in operation for the first time, although the mine was developed and mill completed a year ago.

SAN FRANCISCO, CALIFORNIA—Steelmaking capacity of the United States is now 147,633,670 annual tons. Capacity increased 7,000,000 tons in 1958.

KELLOGG, IDAHO—The Bunker Hill Company has purchased the Jack Pine phosphate lease near Elliston, Montana as a source of phosphate rock for Bunker Hill's new fertilizer plant.

SANTIAGO, CHILE—The Anaconda Company plans to produce at annual rate of over 400,000 tons of copper in 1959 from Chilean mines; 300,000 from Chuquicamata, 100,000 from El Salvador, and 5,000 from La Africana.

GARFIELD, UTAH—The Utah Copper Division of Kennecott Copper Corporation began operating the world's largest copper smelter here for its own account on January 1. Kennecott purchased the smelter from American Smelting and Refining Company who had operated it for many years.

GRAND JUNCTION, COLORADO—Average cost per pound of domestic U_3O_8 concentrate in AEC's fiscal year 1958 was \$9.66. Canadian concentrates bought by AEC cost \$10.77 per pound; overseas purchase costs averaged \$11.75.

ANTOFAGASTA, CHILE—Cerro De Pasco Corporation has developed 96,000,000 tons of 1.6 percent copper ore at its optioned Rio Blanco deposit. Drilling has not delimited mineralization.

GEORGETOWN, IDAHO—First shipment of phosphate rock has been made from Central Farmers Fertilizer Company's new mine in Georgetown Canyon.

NEWPORT NEWS, VIRGINIA—Union Carbide Ore Company is building a 1,000-ton-per-day manganese mill here to treat ores imported from North-Western Guiana Mining Company, Ltd.'s mines in British Guiana.

GRANTS, NEW MEXICO—Quinta Corporation has received an AEC allocation to mine 450 tons of uranium ore daily and ship it to Ambrosia Lake custom mills. Quinta's mines will be developed west of Ambrosia Lake.

EL PASO, TEXAS—Electro Metallurgical Company has purchased a 297,000-ton federal government stockpile of manganese ore at the El Paso airport. Base price was \$0.17 per long ton unit of manganese.

Minera Santa Fe Prospects Chile's Cerro Laco Iron

The Chilean company, Compania Minera Santa Fe, has signed a contract to buy three large iron ore deposits high in the Andes near the Chilean-Argentina border. One outcrop at Cerro Laco is shown above with a man standing at left to indicate size of the deposit. Reserves of high-grade magnetite ore in the Cerro Laco group—El Laco Chico, El Laco Grande, and San Vicente are estimated at several hundreds of millions of tons.

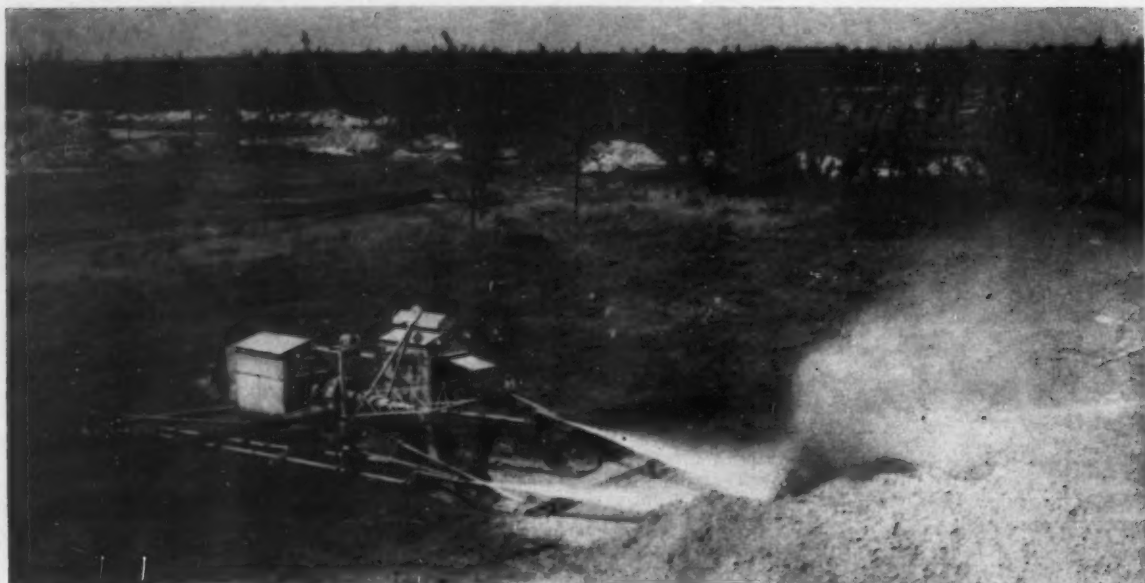


The deposits are about 300 kilometers from the port of Antofagasta at an elevation of 4,500 meters above sea level. Exact location is at the southern end of the Cordón de Puntas Negras at 67° 27' south and 23° 51' minutes west. Minera Santa Fe, an important producer of iron ores in Chile for the last several years, plans an exploration and development program.

Union Carbide Group Buys Government Mn Stockpile

The Electro Metallurgical Company, division of Union Carbide Corporation, has recently purchased 297,000 tons of low-grade manganese ore owned by the United States General Services Administration. The material had been acquired from Mexican producers under the Defense Production Act, and was considered surplus to government requirements; therefore it was eligible for sale.

Under terms of the sale, the purchaser must move the ore from the storage site adjacent to the El Paso, Texas municipal airport within the next two years. The ore was sold on an "as is" "where is" basis at \$0.17 per contained long ton unit of manganese based on ore analyzing 30 percent Mn subject to increase or decrease of \$0.0056 per long ton unit of Mn above or below 30 percent Mn, fractions pro rata.



PHOSPHATE MATRIX is pumped from the open-pit mine to the washing plant as a 40 percent slurry. This picture shows how the high-pressure hydraulic water jets break up the matrix

and pulp it in the pump sump. The matrix is dumped directly into this sump by the large walking dragline used for mining. Picture was taken from dragline.

Cyanamid Floats Coarse Phosphate

At Orange Park Mill to Save on Capital Investment, Floor Space, and Operational and Maintenance Costs

By A. E. ROBERTS
New York District Manager

Experience, utilization of the latest technological advances in equipment and processes, and progressive management have been combined to make American Cyanamid Company's Orange Park mine and plant, located about five miles northeast of Lakeland, Florida, a model operation; and one of which Cyanamid is justifiably proud.

Designed by Cyanamid's engineering staff, the Orange Park plant started in May 1957, replacing the mined out Saddle Creek operation. The plant is compact, designed for ease of operation. Extensive application of automatic equipment and remote controls greatly contributes to plant efficiency.

Although flotation of washer tailings has been in general use since the early 1920's, Cyanamid is the only company employing flotation to recover the coarse particles in the washer tailings ahead of the normal flotation operation.

Of equal importance in contributing to the overall high efficiency of Cyanamid's operation is the excellent

community relations enjoyed by the company. Arthur Crago, manager of phosphate operations, maintains that company goodwill is an integral part of a profitable operation. And Mr. Crago and his staff are diligent in maintaining this goodwill.

Deposit Is World's Largest

The Orange Park mine and plant are located in Florida's Land Pebble Field—the world's largest deposit of high-grade natural rock phosphates. All phosphate mining activities in the Land Pebble Field currently are in Polk and Hillsborough Counties. In 1957 these two counties produced over 11,000,000 tons of phosphate rock—about one-third of the total world output.

Phosphate beds of the Land Pebble Field, locally termed "matrix", were deposited some 15,000,000 years ago, according to geologic studies. At that time the area was a shallow basin and phosphate in solution was carried in by streams, rivers, and ocean currents. Calcium phosphate was precipitated with limestone. Successive variations in sea levels exposed the phosphatized limestone to weathering, dissolving much of the limestone

and leaving enriched phosphate beds.

Pebble phosphate rock was discovered in Florida in 1886, and the first mining operation was on bars in the Peace River near Arcadia in 1888. Operations in the rich land phosphate beds followed a few years later. Phosphate mining at Brewster, plant headquarters for Cyanamid 24 miles south of Lakeland, were started in 1912 by the newly organized Amalgamated Phosphate Company. Mining activities were confined to the Brewster area until 1927 when Amalgamated's first washer outside the Brewster vicinity—Green Bay—was put into operation. In 1930 Amalgamated Phosphate became a wholly-owned subsidiary of American Cyanamid and was absorbed into the Cyanamid corporate structure in 1938.

Area Is Drained Before Mining

Phosphate beds, or matrix, consist of equal parts of phosphate, sand, and clay, and vary in thickness from 5 to 20 feet. The beds are overlain by 4 to 50 feet of overburden. As the surface is swampy, with heavy vegetation, it must be drained and cleared prior to stripping. Future mining areas are usually drained for one year by an

extensive system of drainage ditches feeding to high-volume, low-head couch pumps rated at 14,000 gallons per minute at 14-foot head, and powered by Diesel engines. Depth of overburden, thickness of the matrix, and grade are determined by auger drilling.

At Orange Park, stripping and mining began in the area adjacent to the plant site to provide a settling area. Over 3,000,000 cubic yards of material were moved to build the dikes. It is interesting to note that 1.5 acre-feet of settling area are required for every 1.0 foot mined because of the slow-settling characteristic of the slimes.

Dragline Feeds Slurry Sump

Two Bucyrus-Erie 650B draglines with Esco 18.6 cubic-yard buckets are used for stripping and mining. The two jobs are alternated between the draglines, with one mining while the other is stripping. Each dragline, weighing over 800 tons, has a 175-foot boom and is powered by two, 650-horsepower motor-generator sets. Each digs and moves 1.0 ton of material every 1.6 seconds. Portable electric cables supply power at 4,160 Volts to the draglines.

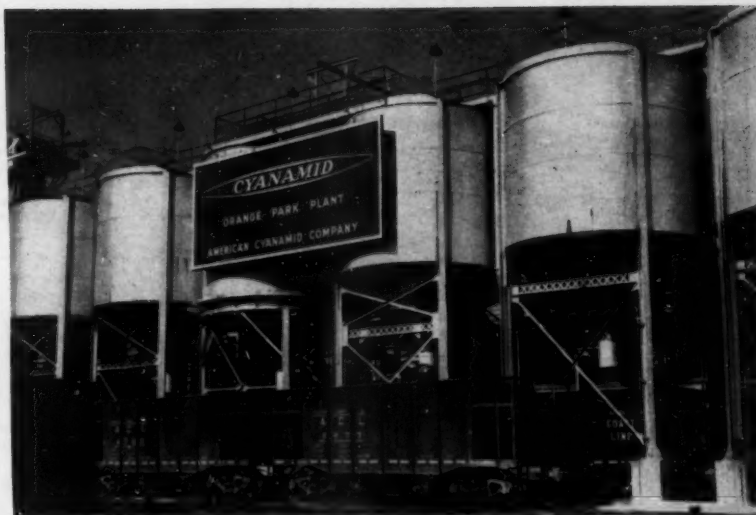
When mining, the draglines make cuts 175 to 225 feet wide, dumping matrix at the pump sump on the bank some 80 feet from the cut line. Limits of the phosphate beds are determined visually and waste is dumped in the mined-out areas.

At the sump the matrix is broken up and slurried by three hydraulic guns (Georgia Iron Works and Universal Nozzle Company) supplying a total of 5,000 gallons per minute at 150 pounds per square inch. An 800-horsepower, 16-inch slurry pump (Georgia Iron Works or Maddox Foundry & Machine, both with interchangeable parts) picks up the slurry and pumps it through 16-inch, heavy-wall, abrasion-resistant steel pipe to the plant. The slurry pump and hydraulic guns are skid mounted and are moved by tractors to a new sump location as mining advances.

Similar slurry pumps are used at boosting stations, and where the pumping distance requires, a relay is added. At the relay station the slurry is discharged into an open well and picked up again by a slurry pump to eliminate water hammer in the lines. An average of 600 cubic yards per hour of slurry (40 percent solids) is pumped to the plant.

Plant Has Three Sections

The plant is basically organized into three sections—washer, feed preparation, and flotation—and a



AMERICAN CYANAMID'S Orange Park plant ships phosphate concentrate (wet rock) 30 miles to the Brewster plant for further upgrading into triple superphosphate. The new Orange Park plant was designed for automatic operation and high efficiency.

product is recovered from each. Wet phosphate pebbles (minus- $\frac{1}{2}$ -inch, plus-14-mesh) are recovered from the washer. An intermediate product, fine washer rock (minus-14-mesh, plus-20-mesh) is screened from the sizers, and flotation concentrate (minus-20-inch, plus-150-mesh) is the final product.

In the early days of phosphate operations, only the coarser pebbles were recovered, the fines being wasted with the washer tailings. The first commercial phosphate flotation operation for fines started in 1929. Oil flotation was used until the late 1930's when the Amine process, which selectively floated the silica particles, came into prominence.

Each circuit of the duplex washer starts from the washer receiving tub. Clay balls formed in the pipe line conveying the slurry from the mine are screened out by $\frac{1}{2}$ -inch bar grizzlies and $\frac{1}{2}$ -inch Tyler rod-deck vibrating screens. Oversize is broken up by hammermills and pumped back to the receiving tub.

Undersize is further screened on 23-foot, punched-plate, flume screens, another pair of Tyler vibrating screens, and the washed in 7- by 33-foot McLanahan & Stone log washers. The washed pebbles advance to the finishing screens and then to the product bins for loading.

Minus-14-mesh material from the screens is dewatered in 10, 48-inch cyclones. Cyclone feed is 14 to 18 percent solids. Slime, minus-150-mesh (4 to 6 percent solids) is pumped to the settling area at the rate of 13,000 gallons per minute. Spigot product is 60 to 75 percent solids and is advanced to the sizer feed bins at 1,000 gallons per minute, or approx-

imately 590 tons per hour. Overflow water from the sizer feed bins is deslimed in a 550-foot-diameter, 25,600-cubic-foot-per-minute, Dorr-Oliver thickener, which is fed by all secondary slimes.

From the sizer feed bins, the material is again screened, and under-size classified by Dorr-Oliver 12- by 28-foot quad rake classifiers. Screen oversize joins the plus-20-mesh sizer product. Classifier overflow advances to the fine feed bins. Rake product goes to 10, 6-pocket Dorr-Oliver sizers.

The sizers operate on the principle of hindered settling classification, continuously producing a number of sized particles. An automatic pressure regulated and power operated mechanism controls the discharge from each pocket. Three groups of particle sizes are discharged from the sizer. Plus-20-mesh product is screened and the oversize goes to the product bins. Screen undersize joins the particles from the middle pockets of the sizer and range in size from minus-20-mesh to plus 65-mesh. These intermediate size particles constitute the coarse flotation feed and are advanced to the coarse feed bin. The third group consists of particles minus-48-mesh in size and make up the fine flotation feed.

Cyanamid's Treatment Is Unique

Flotation of the coarse particles (minus-20-mesh to plus-65-mesh), as mentioned earlier, is unique by American Cyanamid. Other phosphate op-

See overleaf for flowsheets ►

Text continued on page 36

OVERBURDEN
DREDGING
MATRIX
GUNTS
SEAL WATER
SUCTION WELL
SEAL WATER - MIXING WATER
RELAY WELL
TO WASHER
SEAL WATER
RETURN PROCESS WATER FROM SETTLING AREA
OPEN PIT MINE
SEEPAGE PUMP

1 RECEIVING TUB
2 GRITZLY
3 VIBRATING SCREEN
4 VIBRATING SCREEN
5 STATIONARY FLUME SCREEN
6 HAMMER MILL
7 CLEAN UP JUMP
8 CLEAN UP JUMP
9 LOG WASHER
10 VIBRATING SCREEN
11 ELEVATOR
12 PRODUCT BINS
13 UNDERSIZE PUMP

TO BREWSTER
WET STORAGE
WET ROCK CHUTE
50' DIAMETER
SILEX FEED BIN
TO CYCLONE FEED BIN
MINUS 14 MESH
DUPLEX WASHER

* TWO EACH OF ITEMS SO MARKED
DIAGRAM IS FOR HALF OF DUPLEX WASHER

- ① RECEIVING TUB
- ② GRIZZLY
- ③ VIBRATING SCREEN
- ④ VIBRATING SCREEN
- ⑤ STATIONARY FLUME SCREEN
- ⑥ HAMMER MILL
- ⑦ CLEAN UP JUMP
- ⑧ CLEAN UP JUMP
- ⑨ LOG WASHER
- ⑩ VIBRATING SCREEN
- ⑪ ELEVATOR
- ⑫ PRODUCT BINS
- ⑬ UNDERSIZE PUMP

⁹ TWO EACH OF ITEMS SO MARKED
DIAGRAM IS FOR HALF OF DUPLEX WAINES

FEED PREPARATION

FROM WASHER MINUS 14 MESH (1)

TO SLIMES SETTLING AREA (14)

FINE FEED BIN OVERFLOW (9)

OVERFLOW TO THICKENER (13)

TO WASHING CLEAN UP PUMP (12)

TO BREWSTER WET STORAGE (12)

TO FINE FEED BIN (9)

TO COARSE FEED BIN (10)

① CYCLONE FEED BIN (1)
 ② CYCLONE FEED PUMPS (3)
 ③ CYCLONES (4)
 ④ SIZER FEED BINS (2)
 ⑤ SIZER FEED PUMPS (2)
 ⑥ RECEIVING TUB (2)
 ⑦ CAKE CLASSIFIERS (2)
 ⑧ VIBRATING SCREEN (2)
 ⑨ BELT CONVEYOR (2)
 ⑩ SIZER PRODUCT BIN (2)

- ④ CYCLONE FEED BIN (1)
- ⑤ CYCLONE FEED PUMPS (2)
- ⑥ CYCLONES (10)
- ⑦ SIZER FEED BINS (2)
- ⑧ SIZER FEED PUMPS (2)
- ⑨ RECEIVING TUB (2)
- ⑩ VIBRATING SCREEN (2)
- ⑪ GRADE CLASSIFIERS (2)
- ⑫ SIZER (10)
- ⑬ VIBRATING SCREEN
- ⑭ BELT CONVEYOR
- ⑮ SIZER PRODUCT BIN

FLOTATION

COARSE FEED FROM SIZERS →

REAGENTS

TO TAILING DISPOSAL AREA

TO CYCLONE FEED BIN

TO BREWSTER WET STORAGE

WET ROCK CART

REAGENT

ACID

TO CLIMB JETTING AREA

LEGEND:

26 COARSE FEED BIN (2)	36 ACID AGITATOR
27 PUMP (2)	37 PUMP
28 BULK CLASSIFIER (2)	38 CYCLONE
29 ROTARY MIXER (2)	39 VFE BOX
30 AIR CELL ROUGHER (2)	40 VFE BOX
31 FINE FEED BIN (2)	41 THICKENER
32 PUMP (2)	42 PUMP
33 BULK CLASSIFIER (2)	43 PUMP
34 CELL CONDITIONER (2)	44 PRODUCT BIN
35 AIR CELL ROUGHER (2)	45 N.S. CLEANER
	46 PUMP
	47 PUMP
	48 PUMP

COARSE FEED FROM SIZERS →

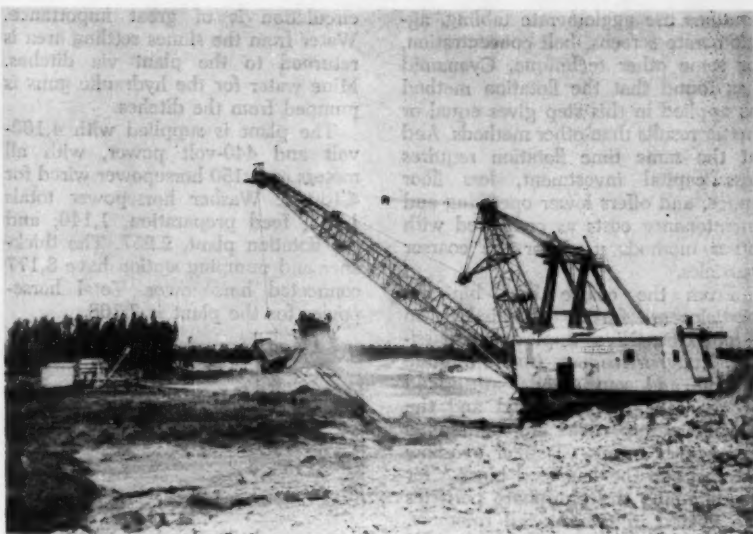
OVERFLOW TO SIZER FEED BIN

CLASS. OVERFLOW

- | | | | |
|----|-----------------------|----|---------------|
| 42 | COARSE FEED BIN (2) | 34 | ACID AGITATOR |
| 43 | PUMP (2) | 35 | PUMP |
| 44 | BANK CLASSIFIER (2) | 36 | CYCLONE |
| 45 | POTATORY MIXER (2) | 37 | VISE BOX |
| 46 | AIR CELL ROUGHNER (2) | 38 | VISE BOX |
| 47 | FINE FEED BIN (2) | 39 | THICKENER |
| 48 | PUMP (2) | 40 | PUMP |
| 49 | BANK CLASSIFIER (2) | 41 | PUMP |
| 50 | CELL CONDITIONER (2) | 42 | FLOCCENT BIN |
| 51 | AIR CELL ROUGHNER (2) | 43 | MIX CLEANER |
| | | 44 | PUMP |
| | | 45 | PUMP |
| | | 46 | PUMP |

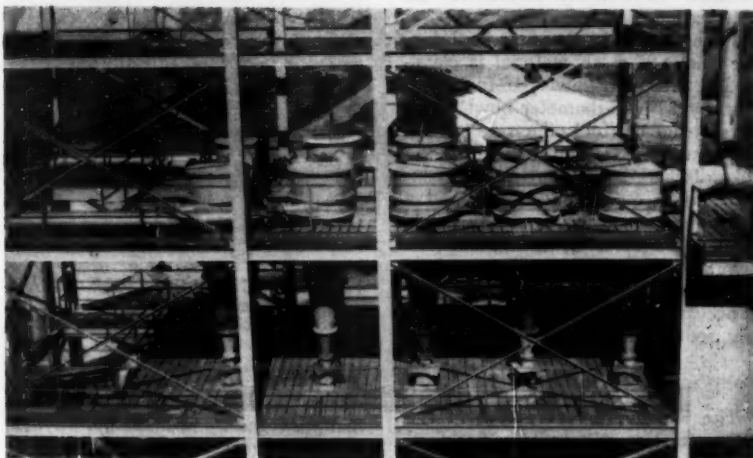
Mining

Walking dragline digs matrix and dumps it into slurry sump. This unit is a Bucyrus-Erie 650B swinging a 18.6-cubic-yard bucket. In the sump, the matrix is slurred with high pressure water and pumped to washing plant. Tree clearing, draining water, and waste stripping precede mining.



Feed Preparation

Cyclones separate slime, minus-150-mesh, material (4 to 6 percent solids) in feed preparation section. These 10, 48-inch units handle 14,000 gallons per minute of feed at 14 to 16 percent solids. Some 13,000 gallons per minute of slime are pumped to settling area.



Flotation

Final flotation concentrate is made by floating the silica away from the rougher flotation concentrate. American Cyanamid's Aeromine 3037 is a cationic collector for the silica. The reagent is dissolved in water to make 5.0 percent solution with which a 1-to-4 mixture of aeromine to kerosene is fed to the six-cell Mineral Separation No. 8 cleaners shown in this picture.



erations use agglomerate tabling, agglomerate screens, belt concentration, or some other technique. Cyanamid has found that the flotation method as applied in this step gives equal or better results than other methods. And at the same time flotation requires less capital investment, less floor space, and offers lower operating and maintenance costs as compared with other methods used for the coarser particles.

From the coarse feed bin the particles are further classified in an 8-foot Dorr-Oliver duplex rake classifier. Rougher reagents (fuel oil, crude tall oil, and caustic soda) are added at the rake discharge end and the plus-65-mesh particles are conditioned in a rotary mixer. Classifier overflow advances to the fine feed bins. After conditioning, the phosphate particles are floated in two air-cell roughers, and the concentrate joins the fine feed flotation concentrate ahead of the acid agitator.

Going back to the fine feed bin, the minus-65-mesh material is classified in two, Dorr-Oliver, 16-foot quad rake by 27-inch-diameter bowl classifiers. Reagents (fuel oil, crude tall oil, and caustic soda) are added at the rake discharge. The particles are conditioned in 4-cell conditioners and a flotation concentrate is made in six air-cell roughers. Cyanamid built its own air cells instead of using standard machines. As no mechanical agitation is necessary, the air machines materially reduce maintenance costs.

Rougher Flotation Is Pushed

The rougher flotation in both the coarse feed section and the fine feed section is pushed to make a clean tailing and a high recovery. And, by so doing, sand particles are also floated with the phosphate particles. The rougher concentrates from both the coarse feed flotation and the fine feed flotation are next cleaned with sulphuric acid in a 4-cell acid agitator, dewatered in two 48-inch cyclones, and then rinsed in 2-stage, 4-unit vee-boxes.

Final concentration is made in three 6-cell Mineral Separation No. 8 MS Cleaners. Aeromine 3037 promoter, dissolved in water to make a 5 percent solution, and kerosene (usually in a 1 to 4 ratio of Aeromine to kerosene) are added after the vee-boxes. Aeromine 3037 promoter, manufactured by American Cyanamid Company, is a cationic collector which selectively floats the silica particles. From the cleaners, the phosphate concentrate goes to the concentrate bins.

As the mine and plant require more than 40,000 gallons of water per minute, conservation of water for re-

circulation is of great importance. Water from the slimes settling area is returned to the plant via ditches. Mine water for the hydraulic guns is pumped from the ditches.

The plant is supplied with 4,160-volt and 440-volt power, with all motors over 150 horsepower wired for 4,160 v. Washer horsepower totals 1,188; feed preparation, 1,146; and the flotation plant, 2,257. The thickener and pumping station have 3,177 connected horsepower. Total horsepower for the plant is 7,768.



PHOSPHATE OPERATIONS MANAGER, Arthur Crago, pioneered development of double flotation process now in general use.

Positive displacement reagent pumps and meter equipment are manufactured by Milton-Roy. Thymotrol switchgear, a direct current control to hold a constant speed setting, is remotely controlled by the operator in the flotation plant.

All wet rock from the concentrate bins is loaded into railroad cars and hauled to Brewster. At Brewster the rock from Orange Park and Cyanamid's mine and plant at Sydney is dumped into a 300,000-ton storage system where it is stacked in piles according to size and grade. Wet rock is dried in three direct-fired kilns. Dry rock is sold as screened rock, ground or unground, to fertilizer or elemental phosphorus manufacturers. Grinding and bagging facilities are maintained in conjunction with the drier installations.

Triple Plant Completed in 1957

The triple superphosphate plant, completed in the middle of 1957, upgrades the phosphate rock to 45 to 48 percent available P_2O_5 (phosphorous pentoxide), which is mostly water soluble. One of the main advantages of the concentrated phosphate is the

savings it provides on transportation costs and handling charges per-unit.

Three processes are involved in the manufacture of triple superphosphate. Sulfuric acid is first manufactured from sulphur. Then the phosphate rock is digested with sulfuric acid, and free phosphoric acid is produced. Treatment of phosphate rock with phosphoric acid produces the triple superphosphate.

Phosphate rock is graded according to the equivalent bone phosphate of lime (BPL) contained. The term BPL originated when fertilizer was first manufactured by acidulating bones with sulfuric acid, and has become a standard term.

Community Relations Pays Off

As mentioned in the earlier part of the article American Cyanamid is diligent in maintaining community goodwill. Conducted tours through the plant are arranged for interested groups and a fine color movie, illustrating and narrating the entire phosphate operation, is available to show at civic and community club meetings.

Reclamation of mined out land is another project of American Cyanamid. Started in 1951 at the Saddle Creek mine, the program now costs approximately \$100,000 per year. The land is graded for further development and many new lakes are created for recreational facilities.

Does this work in public relations pay off? Here's one example which shows that it does. When the Saddle Creek mine was closed, it was necessary to "walk" two huge 800-ton draglines from Saddle Creek to the Orange Park mine. As this involved crossing highways, county roads, and the railroad, as well as private property, and disconnecting telephone and power transmission lines, a lot of "cooperation" was necessary to keep the dragline moving. The Cyanamid staff feels it set a record in moving the dragline, thanks to the splendid cooperation they received from the community.

Management and supervisory personnel at Brewster and Orange Park include: Arthur Crago, manager phosphate operations; K. K. Danton, assistant manager; Erwin Haynsworth, mines manager; J. L. Weaver, development superintendent; R. N. Saunders, assistant mines manager; F. A. Vogler, Orange Park mine superintendent; and Frank Boyd, Orange Park mill superintendent.

MINING WORLD would like to thank Mr. George Oppel, manager of Manufacturing, Agricultural Division, American Cyanamid Company, and Mr. Crago and his staff for their excellent cooperation in making this article possible.

THE END



TUNNEL PORTAL and construction camp for Utah Copper Division's new low-level haulage tunnel at Bingham Canyon, Utah. When the pit bottom reaches the tunnel level, ore will

be hauled through the tunnel instead of over tracks at right which lead to the pit. Waste benches from stripping upper levels of the pit cover the mountain side at top right.

Kennecott Tunnel

Utah Sets Records at Bingham Canyon

Utah Construction Company has driven the new 5490 level railroad tunnel for Kennecott Copper Corporation's Utah Mines Division ahead of schedule. In fact, during the record month of March 1958, with only 26 working days, 1,363 feet of 18-by 24-foot tunnel were driven with the best day's footage being 66 feet.

"When we started the Bingham Canyon tunnel in November of 1956," notes Paul C. Guinn, project manager for the Utah Construction Company which is driving the tunnel, "the estimated completion date was set for sometime in 1960. While we felt then that we could finish the job by mid-1959, we have now reduced that estimate to early in 1959."

Kennecott's Utah Coppermine at Bingham Canyon is the largest open-

pit copper mine in North America. Each year, as the pit is dug deeper, the cost of hauling the ore out of the bottom of the pit and over the rim increases correspondingly. Consequently, Kennecott is presently driving its third tunnel into the mine.

When completed, the 18-foot-wide by 24-foot-high bore will measure 18,000 feet long, and the project will cost \$11,000,000.

Since they began driving the tunnel back in November 1956, typical heading crews of 33 men per shift have advanced an average of 28 feet per day. Advance on one record-breaking day alone was 0.66 lineal feet of tunnel per man.

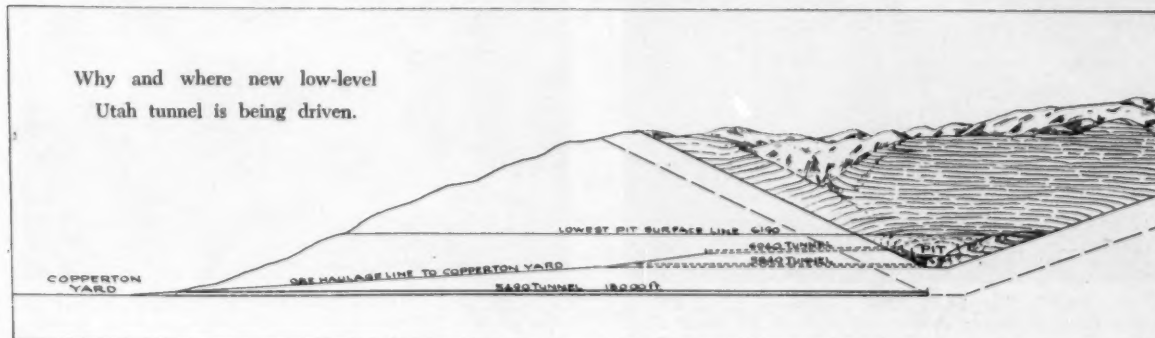
Such rapid progress, according to the tunnel contractor, was the result of a combination of important fac-

tors: rock being excavated, personnel, and type of equipment being used. In addition, Utah Construction spokesmen admit they had good luck in the type of rock they were driving through.

When Utah Construction crews first began the Bingham Canyon tunneling operation, they drove through 3,500 feet of andesite. However, during late winter of 1957 and into spring and summer of 1958, the tunnel drivers encountered a good deal of hard quartzite, which stands very well and does not slough off.

Record-Breaking 8-Hour Shift

In one record-breaking 8-hour shift, 650 loose yards of hard quartzite, the equivalent of approximately 450 cubic yards of solid rock, were hauled out



Why and where new low-level
Utah tunnel is being driven.



SPECIFIC GRAVITY of C & D Slyver-Clad Type MHA mine locomotive batteries is checked by John Gately, chief electrician. A total of 14 sets of batteries are used.



UTAH'S PROJECT MANAGER, Paul C. Guinn, stands just inside the portal of the 5490 tunnel. All muck and supplies are hauled out and into the tunnel by battery locomotives.

of the tunnel by Utah's battery-powered muck trains.

In a typical cycle, the 33-man heading crew drilled 85 holes to a "Vee" cut to the center for a 15-foot round in 90 minutes. Holes were loaded with 40 percent gelatin powder and 11 delays of electric blasting caps in 30 minutes, for a powder factor of 2.5 pounds per cubic yard in the hard Bingham quartzite.

Mucking of the 450 cubic yards of loose material per round with a Conway 100-1 mucking machine took 2.5 hours. Material was hauled to the portal dump site by the 9-car electric trains.

Following the mucking operation, wide flange prefabricated steel sets were stood from 2 to 6 feet apart in

the tunnel, with timber lagging placed behind the sets.

An hour and a half to place and timber lag completed the cycle, two and three sets of 6-inch H20 pound steel sets being used to support the ground. Approximately 200 board-feet of native fir per foot of tunnel are used for the lagging.

Simultaneously with activities at the face, concrete operations were carried forward approximately 1,200 feet from the heading. Continuous movement of fresh concrete from the portal batch to the steel arch and wall forms in the tunnel was expedited by use of the battery locomotives pulling 7-cubic-yard Worthington mixers.

With aid of two California switches, 60 feet of tunnel using 250 cubic

yards of concrete can be lined each day, in no way interfering with operations in the heading.

The 9-car muck train makes an average of nine trips per shift during this 3-shift operation. Cars have an 8-cubic-yard capacity. Thus, the muck train is able to remove 72 cubic yards per trip, or 648 cubic yards per shift.

"Tunnel driving involves enough natural hazards without taking unnecessary chances," explains project manager Guinn.

When it comes to rock and earth hauling equipment in tunneling operations, in the opinion of Utah Construction Company's project manager, battery-powered locomotives with electric traction motors provide several basic advantages.



AT THE FACE. This picture shows only one of the 10 CF 93 3½-inch Gardner-Denver drifters mounted on the multi deck jumbo. A typical round of 85 holes is drilled in 40 minutes.



CONCRETING CREWS follow the heading crews but are always about 1,200 feet apart, so that both can work simultaneously, yet not get in each other's way.

Record Figures

Utah Construction Company has established an impressive record in driving the Bingham Canyon tunnel. The figures tell the story:

Average advance

9.33 feet per shift.
0.28 feet of tunnel per man per shift.
1.68 feet of tunnel per man per shift week.
7.28 feet of tunnel per man per shift month.
0.66 feet of tunnel per man per record-breaking day.

Average cycle per round

While cycle time varies, a 3-hour cycle is considered average.

This is broken down into:

Drilling 8-foot round	40 minutes
Loading and shooting	20 minutes
Mucking	90 minutes
Setting steel and timber	30 minutes
Total	3 hours—00 minutes

Average powder consumption

In 4,000 feet of volcanics and porphyry 1.6 pounds per cubic yard

In 11,500 feet of quartzite and other sedimentary rock 2.8 pounds per cubic yard

Rock excavated

Up to October 1, 1958 272,000 cubic yards of solid section

Average timber

225 board-feet per foot of tunnel

Concrete lining

Placed up to December 21, 1958 15,619 feet totaling 47,000 cubic yards



PORTABLE JUMBO is used to support drills and miners so that the full 24-foot-high face can be drilled out at one time. Steel sets and wood lagging are clearly shown.

"In our application, where heavy loads are the rule rather than the exception," sums up Guinn, "these units are rugged, powerful, quiet, and they avoid any dangerous build-up of gas or fumes in the tunnel."

Utah engineers credit the high-efficiency muck trains for the important part this hauling equipment has played in the record-breaking performance at Bingham Canyon. The speed with which the tunnel is driven is necessarily limited by the hauling capacity of the trains. Moreover, train capacity is controlled, in part, by the batteries which provide the locomotives with motive power.

In all eight locomotives, power is supplied by C & D Slyver-clad batteries. While the batteries are not all in simultaneous operation, of course, a breakdown in just one or two of them could understandably cripple the speed and efficiency of the entire tunneling project.

Among the important responsibilities of chief electrician John P. Gately is making certain that the electric locomotives and batteries are in good working order at all times. His shop, located only a few yards from the tunnel portal, is equipped with convenient trackage, battery recharging equipment, and a mobile overhead crane to facilitate lifting the battery units on and off the locomotives.

A full load of rock for the nine cars weighs an average of 160 tons, putting a heavy drain on the locomotive

batteries. However, Utah maintains that the C & D batteries are still providing the same strength today as when they were put into operation two years ago.

Another factor which entered into Utah's decision to use these batteries was their resilient Hi-Impac cell casing material which resists cracking

and breaking.

"One day last winter, when a track slipped," reports chief electrician Gately, "we had one of our locomotives roll over a 15-foot embankment on top of its battery assembly.

"However, upon inspection, we were amazed to find that not one battery had broken. The only damage consisted of a loss of electrolyte and shorting out of the positive and negative terminals, which we replaced. Voltage readings taken after the addition of electrolyte showed that all cells were in perfect working order."

Predict March Completion

Work completed up to October 1, 1958, included 15,434 feet of heading, 13,903 lineal feet of concrete lining, placing of 3500 sets of tunnel steel weighing 6,000,000 pounds, and placing 3,500,000 board feet of timber lagging. As of December 21 the tunnel was 16,736 feet long with 15,619 feet concreted.

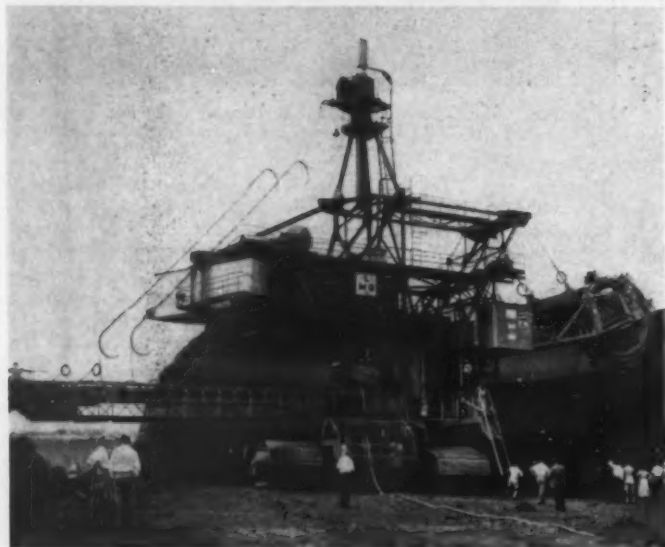
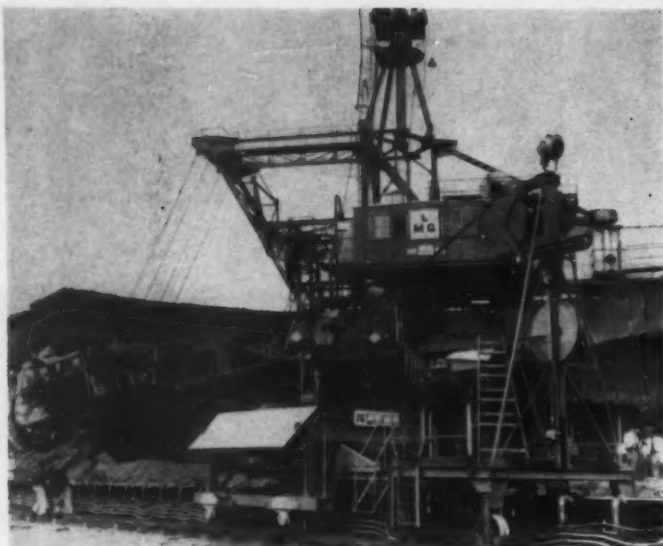
Progress during October and November was slowed somewhat due to contact with the porphyry ore-producing zone at station 16,500. However, Utah Construction expects to complete the tunnel around March 1, 1959.

The final 1,700 feet of tunnel will be timber supported in order to allow Kennecott to excavate this portion some five to 10 years hence, when the pit level will be down to the tunnel elevation.

THE END

Tunneling Equipment

- 2 Series 100-1 Conway mucking machines with 1¼-cubic-yard dipper; one in use, and the second used for a spare in case of a breakdown.
- 30 8-cubic-yard Moran muck cars.
- 13 CF93 3½-inch Gardner-Denver drifters; 10 mounted on jumbo, and three spares.
- 1 Combination cherry picker and drill jumbo designed by Utah engineers and built by Utah in Salt Lake City.
- 6 7-cubic-yard Worthington concrete mixers mounted on Moran chassis cars.
- 1 150-ton Noble batch plant.
- 3 WN 114 Joy compressors, 1828 cfm, 300 hp.
- 1 Jumbo-mounted Blaw-Knox steel arch forms.
- 1 Concrete jumbo, designed and built by Utah.
- 2 Westinghouse battery locomotives, 10-ton.
- 3 Goodman battery locomotives, 10-ton.
- 3 Greenberg battery locomotives, 8-ton.
- 14 C & D Slyver-clad® type MHA battery sets for locomotives.



Bucket Wheel Excavator

The Orenstein-Koppel bucket-wheel excavator was built in West Germany and shipped to Nchanga where it was assembled in an area adjoining the pit. It was then 'walked' down into the pit and started digging.

The excavator weighs 408 tons and supports a 20-foot 4-inch-diameter bucket wheel. Eight buckets on this wheel each have a 0.45-cubic-yard capacity.

Digging rate of the unit depends on the speed at which the wheel is turned which is governed by the type of material dug. There are three wheel speeds and their excavation rates are:

Buckets per minute	48	60	72
Loose cubic yards per hour	1,075	1,325	1,600
Bank cubic yards per hour	825	1,020	1,230
Tons per hour	1,234	1,520	1,836

The excavator will dig an 86-foot-high face without moving the main conveyor belt. This entails a high and low cut. The pictures show the first of two high cuts which will be 41 and 12 feet, respectively. The low cuts with elevation to conveyor will be 17 and 16 feet. Note how three swings are taken for the 41-foot-high cut.

Bucket Wheel

Nchanga Consolidated Copper Mines Limited has developed two open pits—Nchanga and Chingola—at its Northern Rhodesian copper mine. These pits have been developed so that mill feed will conform to the average grade of all Nchanga ore reserves—estimated at 4.6 percent copper. Before the pits were placed in production, all ore mined underground from the Nchanga West ore body had averaged 7.0 percent. Accordingly, plans were made in 1954 to develop the lower grade pits to mill 150,000 tons per month of pit ore, and decrease higher grade underground production.

Initially the Nchanga pit was stripped by two 150 B Bucyrus-Erie electric shovels loading Caterpillar-Athey D. W. 20 side loading wagons and D. W. 21 rear dumpers. Diesel powered trains were also loaded in the pit by the shovels. At times, the wagons dumped their loads into the railroad cars. Trains were then hauled to waste dumps. Chingola, a smaller all-truck pit, was stripped by the same equipment with the addition of Euclid Diesel trucks.

Chingola ore is trucked from the pit while all Nchanga ore is dumped into two 8-foot-diameter, concrete-lined ore passes to the 625 underground sub-haulage level. Ore is drawn and trammed to 625/970 ore pass and from there along 970 main haulage level to C and D shafts for hoisting to surface with the underground ore.

Late in 1958 Nchanga placed a bucket-

Belt Conveyor System

Overburden from the excavator is carried by conveyor belt to the dump stacker. There are three separate main conveyor sections. The center section, outside the pit and extending to the dump is permanent. Initially, it was 5,500 feet long, and eventually will be extended to 7,500 feet.

Feeding the permanent section is a series of bench belts on one of which the excavator loads. These bench belts can be moved laterally without being dismantled as the bench is widened. They also can

Stripping at Nchanga's Copper Pit

wheel excavator, belt conveyor system, and crawler mounted dump stacker in operation at the Nchanga pit. The company held an 'open house' when the equipment was commissioned and authorized publication of this article.

The excavator is stripping the north side of the pit, loading directly onto the overburden disposal conveyor belt system. Whenever possible, the rubber-tired wagons, loaded by a 150 B shovel, will dump their loads directly onto conveyor belt. The pit now is about 4,000 feet long, 1,000 wide, and 140 deep. About 12,500,000 bank cubic yards of overburden have been stripped, 640,000 tons of ore milled, and 1,450,000 tons of ore stockpiled.

Ore exposed for mining, and which can be mined without further stripping, totals 1,424,000 tons. Ore 43.5 percent developed is 6,864,000 tons, and probable ore is 6,821,894 tons; all average 3.6 percent copper.

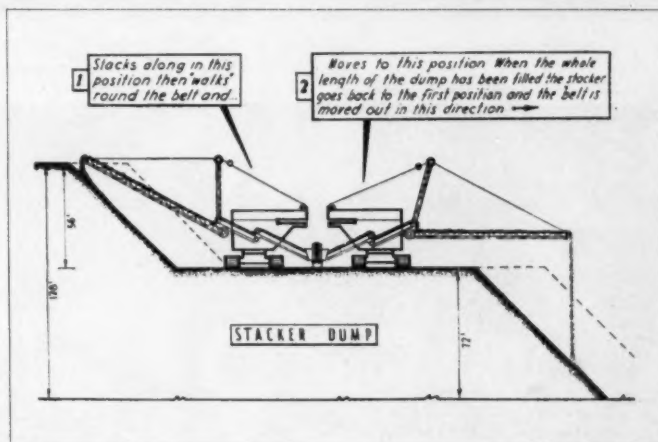
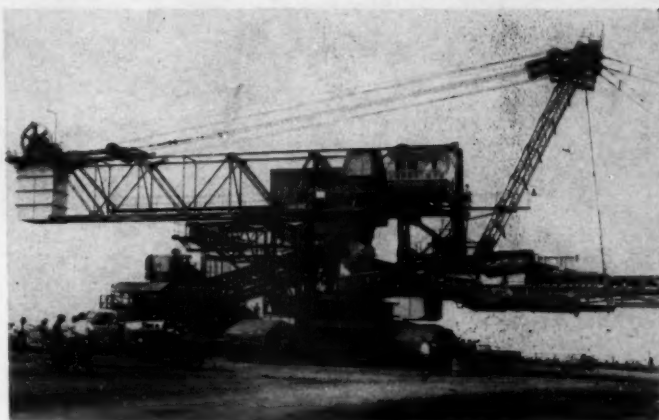
The bucket-wheel excavator will have plenty of stripping to do, as the following stripping ratios show. They are calculated for a complete pit, i.e. when all ore and overburden have been mined.

Block	Block Ratio	Progressive Ratio
Present to 400 feet	7.0 : 1.0	7.0 : 1.0
400 to 600 feet	8.7 : 1.0	7.9 : 1.0
600 to 800 feet	13.8 : 1.0	9.7 : 1.0

be broken into units for transfer from one bench to another. The third main belt section is on the dump and it, too, can be moved laterally without being dismantled.

When the excavator started, there were 12,500 feet of 48-inch-wide belting in the system. Belt speed is 800 feet per minute with three-pulley 20° troughing idlers.

This is believed to be the longest conveyor belt system in Africa and one of the longest ever used on a stripping job. The Morton Ore Company used a comparable belt system for stripping its Morton mine at Hibbing, Minnesota. However, a walking dragline was used for excavation.



Overburden Stacker

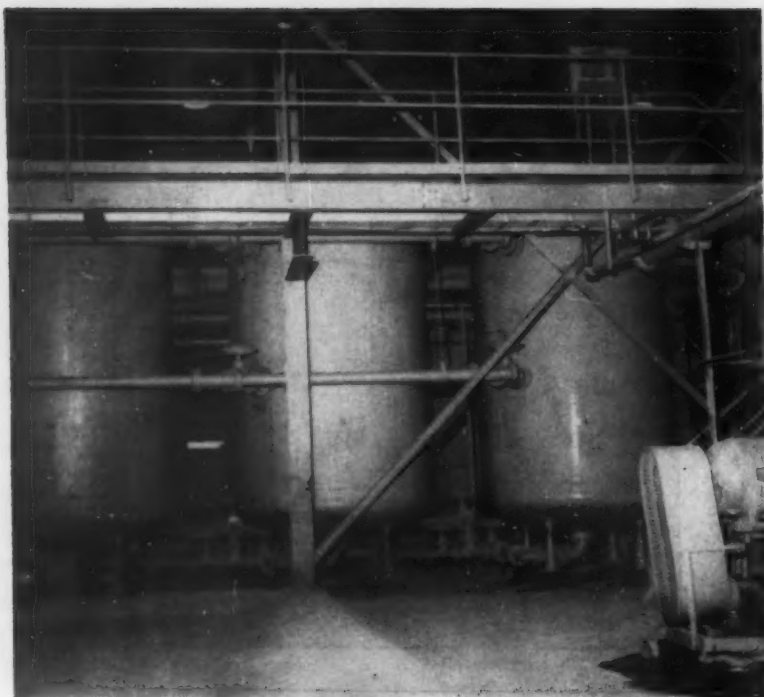
A crawler mounted boom stacker is used for disposal of the overburden. Initially, the stacker dump will be 3,000 feet long and will be extended an additional 3,000 feet to the north.

The Orenstein-Koppel stacker is crawler mounted, weighs 388 tons, and has a rated capacity of 3,780 tons per hour. Note that this is much larger than the tonnage the bucket-wheel excavator can deliver. However, as pointed out in the description of the main belt, a considerable tonnage of overburden will be dumped on this belt from stripping trucks.

The stacker is fed by a transfer conveyor running at right angles to the main belt and into the center of the stacker. This unit weighs 130 tons.

Three belts on the stacker travel at progressively higher speeds so that the overburden is thrown off the stacker boom belt at a velocity of 1,120 feet per minute to build a larger pile from one setting.

The 164-foot-long discharge boom can be raised to build a 56-foot-high dump on the high side. Initially, the stacker will work off a 72-foot-high dump. The line drawing above shows how the stacker builds two piles from one setting of the main belt.



Ion exchange resins are pumped through process cycle in column circuit

At Lucky Mc's acid-leach uranium plant in the Gas Hills of Wyoming

Why Moving

It cut capital costs . . .
It saves on reagents . . .
And it is efficient . . .

By STANLEY H. DAYTON
Associate Editor

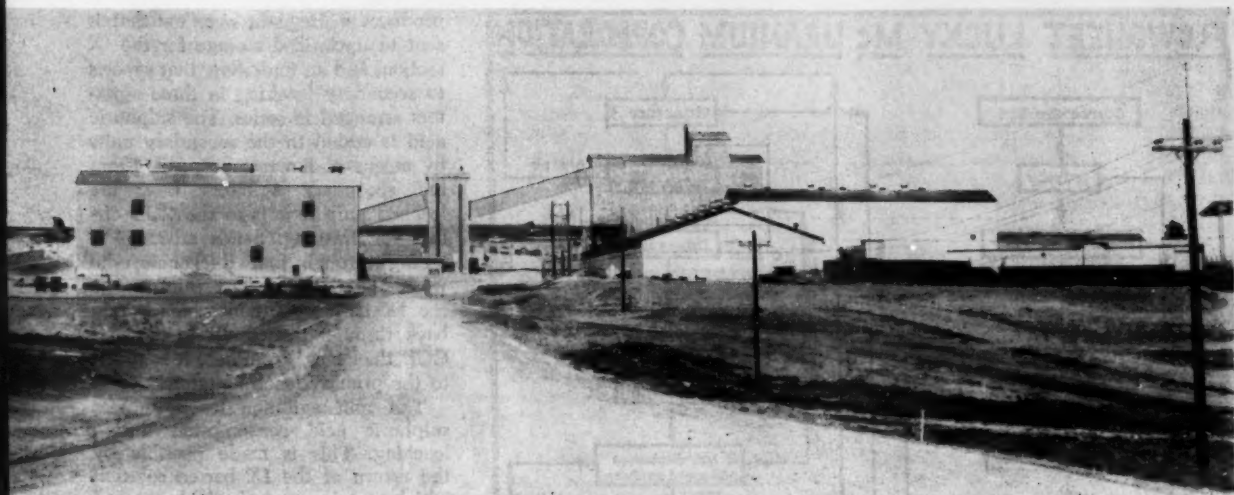
Last March (1958) Lucky Mc Uranium Corporation recovered its first yellow cake from a new mill, 50 miles east of Riverton, Wyoming, which is regarded as one of the most unique in the United States. Highlight of the new plant: an ion exchange circuit equipped with resin-loaded columns interconnected to permit the resin to be pumped out of any column on adsorption and through backwashing and elution columns before it is returned for further adsorption service.

Lucky Mc's mill is the first in the United States to use the moving bed process. Other column-equipped plants are operated on a fixed bed principle. Here the resin never moves out of the column but is rotated between adsorption and elution by piping the appropriate solution to the column. The moving bed process, though chemically similar to any other ion exchange circuit, represents quite a radical mechanical departure from existing treatment schemes.

In two other respects, Lucky Mc's new mill is somewhat unusual. A large percent of the acid leach solution is recovered in the ion exchange circuit and recycled to dissolve more ura-



COLUMN FLOWSHEET in control panel contains all indicating devices needed to give a graphic picture of the circuit. Resin transfer and processing is usually controlled automatically, but manual over-ride switches are included.



Bed Ion Exchange System Was Selected

nium. Secondly, provision has been made for recovery of the nitrate adsorbed during elution.

The Lucky Mc mill campsite and auxiliary facilities were designed and built by Utah Construction Company for a reported cost of \$6,900,000. It was finished just 11 months after ground was first broken, in spite of heavy spring rains that prevailed in 1957. The new plant is Wyoming's second, but largest, uranium processing installation.

Though nominal capacity of the mill is given as 750 tons-per-day, it is capable of processing 1,000 tons of ore daily, and has been operated at a rate as high as 1,200 tons per day.

The moving bed ion exchange system is a patented process first tested and developed in South Africa by Robert Porter, Salt Lake City, Utah metallurgist. The first North American mill utilizing this highly efficient processing technique was Consolidated Denison in the Blind River area of Canada. Today, six moving bed ion exchange plants are scattered throughout the world. Mr. Porter, consulting metallurgist for Lucky Mc, licensed Dorr-Oliver, Inc. to install the resin-transfer ion exchange circuit at the Lucky Mc plant.

Several basic reasons have been cited for adoption of the moving bed at Lucky Mc.

Efficiency of the system is high because elution can be carried out on a more nearly uranium-saturated resin. This is because certain columns are continuously on adsorption, and the

flow of pregnant leach solution is never interrupted by the necessity for displacing wash water.

Smaller reagent quantities are required during elution if resin is saturated with uranium. It also follows that a higher concentration ratio will result between the pregnant leach solution and the concentrated eluate recovered from the ion exchange system if less eluant is used.

Capital expense for installation of the moving bed system is said to be lower than for a fixed bed system. This is because smaller columns can be used for adsorption and elution, while one large column handles all backwashing. In the fixed bed circuit, larger columns are required to take care of the expansion which results when a column is backwashed to raise, re-sort, and flush the bed of resin. Piping for the moving bed installation is also simpler.

A lower resin inventory is required for the moving bed process say its proponents. The Lucky Mc mill has 10 columns in the processing cycle loaded with a total of 2,500 cubic feet of resin, and is designed to handle 6,000 pounds of uranium per day.

Moving bed enthusiasts say that uranium can be produced at a lower cost per pound by their system than with the solvent extraction method which attracted a great deal of attention recently. They also point out that the moving bed process is less susceptible than fixed-bed columns to mechanical blockage during treatment cycles, since the bed of resin

is loosened and broken during transfer.

Mechanical attrition of the resin is surprisingly less in the moving bed process than in R.I.P. circuits. The bed of resin beads in an R.I.P. plant is expanded and contracted during every cycle the basket makes in its bath. In the moving bed process, any single bed volume in an adsorption column is moved only once per day through a backwash column, an elution column, and back to the adsorption line. Time to move one bed volume (250 cubic feet at Lucky Mc) from one column to another is about 16 minutes. Thus the resin in any adsorption column will actually be in transit only about 48 minutes per day.

The moving bed process is the closest approach yet developed for utilization of columns in a mechanically and chemically efficient, continuous, counter-current circuit. At Lucky Mc, the IX section was designed for automatic control or for remote manual control from one main instrument panel.

Storage and blending of ore was described in a previous article (see MINING WORLD, October 1958, pages 30 to 35). The ore is bedded in layers, picked up by a front-end loader, and trucked to the mill where it is dumped in a 50-ton truck hopper.

Crushing is carried out in two stages by Cedar Rapids impactors. The most unique feature of the crushing plant is a 10-foot by 80-foot rotary dryer made by Stearns Roger Manufacturing Company. It was in-

FLOWSHEET LUCKY Mc URANIUM CORPORATION

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graph TD; COB[Coarse Ore Bin] --> G[Grizzly]; G --> PC[Primary Crusher]; PC --> OD[Ore Dryer]; OD --> RDS[Rod Deck Screen]; RDS --> SC[Secondary Crusher]; SC -- sample --> ST[Sample Tower]; ST --> OSB[3 Ore Storage Bins]; OSB --> RM[Rod Mill]; RM --> C[Cyclones]; C -- sulphuric acid --> PA[2 Primary Agitators]; C -- o'flow --> T1[Thickener 1]; PA --> T1; T1 -- pregnant solution --> PS[Pregnant Solution Column]; T1 -- o'flow --> SA[sulphuric acid]; T1 -- sodium chlorate --> ASA[3 Secondary Agitators]; ASA -- steam --> ASA; ASA --> T2[Thickener 2]; T2 -- barren solution --> BS[Barren Solution Column]; T2 -- o'flow --> TH3[Thickener 3]; TH3 --> TH4[Thickener 4]; TH4 -- o'flow --> TH5[Thickener 5]; TH5 -- to tails --> TT[to tails]; TH5 -- Clarifier --> C1[Clarifier]; BS --> C1; C1 --> IEX2[2 Ion Exchange Adsorption Sets resin]; IEX2 -- Backwash resin --> BW[Backwash resin]; BW --> IEX1[1 Ion Exchange Elution Set]; IEX1 -- conc. eluate lime --> IP[Iron Precipitation]; IEX1 -- caustic --> CA[caustic]; IP --> F1[Filter]; F1 --> UP[U3O8 Precipitation]; UP -- caustic --> UP; UP --> F2[Filter]; F2 --> UD[U3O8 Dryer]; UD --> BR[Barrels To Refinery];
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Grinding is carried out in a 6- by

The leaching circuit is arranged for split-agitation, acid extraction of uranium from the ore. In this respect the mill is almost identical to Dawn Mining Company's plant described in February 1958 MINING WORLD. It consists of a first-stage leach with return IX barren solution which has been advanced through a CCD system of four thickeners. The first-stage extraction is carried out in two agitators in series. The first stage agitators discharge to a thickener; the thickener

The four CCD thickeners and the thickener on primary service all measure 100 feet in diameter by 12 feet high. Three were made by

National Tank & Pipe Company and two were furnished by Santa Fe Tank & Tower Company. The rakes of all thickeners are made of stainless steel. Separan is added to each of the thickeners. To avoid loss of soluble uranium in the sands which advance to tailing, the flocs produced by the thickening aid must be broken by agitation of the pulp in small rubber-lined tanks ahead of each thickener.

The leaching and CCD circuits are tied together and are regulated from two motor control centers. Both motor

control centers are interconnected with an automatic auxiliary Diesel power plant to compensate for the infrequent electrical outages.

Pregnant solution from the leach circuit reports to a wood stave tank, 34 feet in diameter and 12 feet high, which provides 72,800 gallons of storage. A leaf-type clarifier is used to remove all but traces of solids from the IX feed. Diatomaceous earth is used as a filter aid during clarification. It is of interest to note that many fixed-bed column plants have been

able to eliminate the clarification step. This is because the resin in each adsorption column is backwashed prior to the elution cycle. This is not the case with the moving bed process. All backwashing is done in a separate column after the resin is transferred. The adsorption column, therefore, is never backwashed, and thus there would be a tendency for slime to accumulate in the bed of sand on which the resin rests. This could eventually cause blinding of the column unless the feed is clarified.

How the Moving Bed Ion Exchange Works

The moving bed installation is composed of 10 columns. Six of the columns are grouped in two parallel lines of three each for adsorption service. Three columns are on elution and the tenth column is used for backwashing uranium-saturated resin beads. The adsorption and elution columns measure 7 feet in diameter by 9 feet high. The backwashing column is 7 feet in diameter by 16 feet high. All are constructed of steel and lined with rubber. Each of the columns is loaded with 250 cubic feet of Permutit SK anion-exchange resin. This is equivalent to 1,875 gallons of solution or one bed volume. The concentration ratio achieved in the IX circuit is between 15 and 18 to 1.

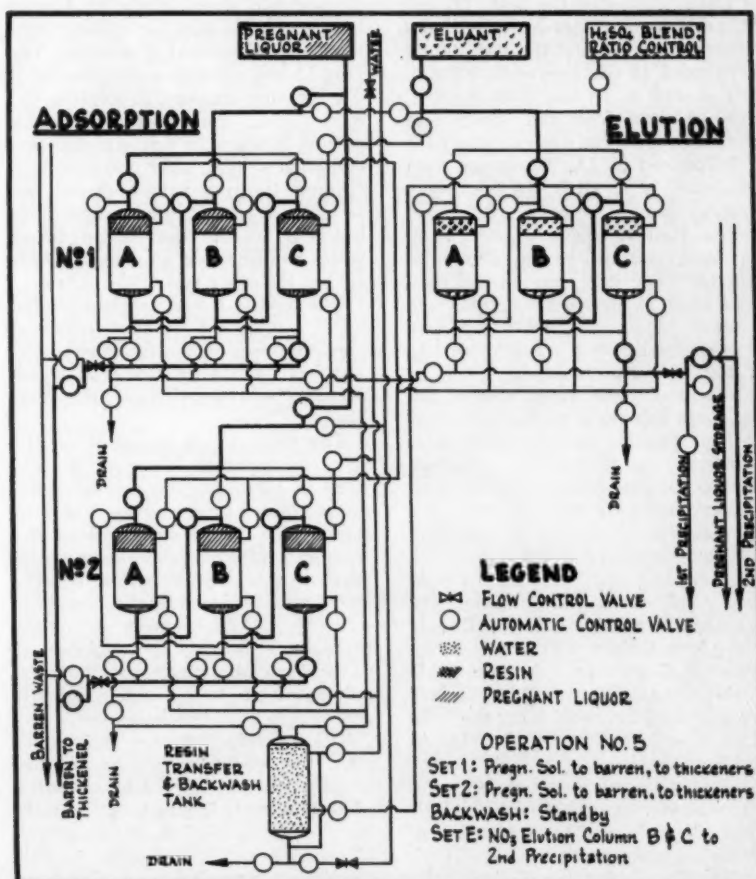
The moving bed columns and the interconnected piping are laid out so that resin in any adsorption column can be transferred to the backwash column. The resin in the backwashing column can be transferred to any elution column; and the resin in any elution column can be pumped to any adsorption column.

The Lucky Mc ore contains variable amounts of molybdenum. This element is one of the most notorious of the resin poisons (an ion that is adsorbed by a resin, but not completely removed during normal elution cycle). The presence of molybdenum is detected by slight discoloration in the sulphuric acid rinse which follows the elution cycle. Most of this element is removed during this rinse, but, to avoid a build-up with eventual blinding of the resin to uranium, two additional columns with one spare bed volume of resin were installed at the plant. These units make up a resin regeneration circuit which is operated only periodically by manual control. Resin can be pumped from any elution column to the regeneration circuit when required. From the regeneration circuit, the resin can be pumped back to any adsorption column. The columns in the regeneration circuit are 7 feet in diameter by 15 feet high.

The circuit is set up so that pregnant feed is split between the two lines of adsorption columns. Within both lines the solution is introduced at the top of the column and exits through the bottom of the column in any progressive series of combination (for example, 1A-1B-1C, 1B-1C-1A, 1C-1A-1B). The barren effluent from the final column on the loading (ad-

sorption cycle) reports to a 34- by 12-foot wood stave tank where it is recycled to the CCD thickeners in the leaching section.

To describe the sequence, assume the first cycle is in progress with columns 1A-1B-1C and 2A-2B-2C being loaded in that order. The cycle actually is staggered between the two lines so that a column in one line



SCHEMATIC FLOWSHEET of ion exchange circuit shows how columns are interconnected for resin transfer and with solution piping. Bold face lines indicate the actual flow during a typical cycle when eluate reports to precipitation.

Control Panel and Instrumentation for Ion Exchange Circuit

The entire moving bed system is provided with a master flowsheet-type control panel equipped with indicating lights and set for automatic or remote manual control. Nine adjustable reset impulse counters are available for controlling operations. These include: adsorption to barren (one for each adsorption set); flush to barren (one for each adsorption set); eluate to pregnant; eluate to first precipitation; eluate to second precipitation; sulphuric to precipitation; and flush to precipitation.

Five Fischer and Porter rate of flow recorder-controllers indicate adsorption flow in each of the two lines, elution flow, backwash flow, and resin movement flow. Three Fischer and Porter integrators work from the recorder controllers for adsorption and elution flows. The system

is provided with alarm horns for high and low flow, power failure, etc. Manual switches are included which override all automatic motor operated valves. There are push buttons for "adsorption complete" on each adsorption set and "barren diversion" at any stage. The backwash column is provided with a timer with a 2-hour dial. Two resin movement timers are installed, each having 1-hour dials. Separate pressure gauges are mounted on each column.

The ion exchange circuit is preferably set for automatic operation. Adsorption is counted out on volume. A warning horn sounds prior to "adsorption complete." The operator, after checking the effluent from adsorption, can reset the volume counter to complete the cycle.

becomes saturated with uranium before the column of the next line is completely loaded. The first column in the series has been on adsorption the longest and, therefore, will be loaded first. When cycle 1A-1B-1C is completed, the flow of pregnant solution is cut-off column 1A. It is given a flush, top to bottom, with one bed volume of water. Following the flush, 1B and 1C are put on-stream for a 2-column adsorption series, and the resin of 1A is pumped to the backwash column. Just as soon as 1A has been emptied, stripped resin from the appropriate elution column (in this example EC) is introduced to 1A. Adsorption then continues in a 1B-1C-1A sequence. Transfer of resin between columns requires about 16 minutes. Line 1 is on 2-column adsorption for about 32 minutes while it is emptied and then filled again. A normal adsorption cycle requires about six hours; the flow through the line is at a maximum rate of 350 gallons per minute.

The uranium-saturated resin in the backwash column is washed for about an hour (bottom to top) before it is transferred to the elution columns. The backwashed resin is transferred to EC for elution in series EB-EC. Column EA is in standby during this operation. Elution in EB and EC takes place in two stages. When EC is half stripped of uranium, EB is completely stripped. The third column, EA, is then given a rinse with two bed volumes of 5 percent sulphuric acid. During the acid rinse it is interlocked in series with EB. Following the acid rinse, one bed volume of water is added to displace the acid in EA to EB. The resin of EA then becomes the product that will be delivered to adsorption column 2A on completion of the next adsorption cycle. Total elapsed time during the elution cycle is a little over two hours.

The eluant used consist of a 0.5 mol nitrate solution made up with

acidified sodium nitrate. On completion of the elution cycle just described above, backwashed and saturated resin is next pumped into column EA. Fresh eluant is then put on EC and EA in series; total amount added consists of eight bed volumes. The first two bed volumes in the effluent of column EA are pumped back to the holding tank ahead of the IX adsorption circuit because the effluent contains a small amount of uranium. The next 1½ bed volumes in the effluent of EA contains uranium, in solution, but only a small amount of nitrate. This portion is taken to first uranium precipitation so that, after uranium is recovered, the supernatant solution can be washed without losing nitrate. This leaves a void in the elution circuit which can be made up with sulphuric acid at the other end of the circuit.

The next four bed volumes coming off of column EA are sent to second precipitation which is described later. This ends the actual cycle in which uranium is stripped from the resin beads.

The next step is to introduce the two bed volumes of sulphuric acid rinse to column EB which has been on standby during elution. The purpose of the rinse is to regenerate the resin and rid it of contaminating ions. Since this is done in series, EB-EC, the nitrate displaced by the rinse from columns EC-EA returns to eluant make-up. The one bed volume of water flush also pushes another bed volume of nitrate out of EA which is returned to eluant make-up.

The resulphating step is incorporated to recover the nitrate solution, which results in reduced consumption of this reagent. It also puts the resin back in the bi-sulphate form and exchange rates with uranium in this condition are much higher. Also there is the obvious advantage of cleansing the resin of contaminating ions during resulphating.

Precipitation of the low-nitrate eluate takes place in a rubber-lined steel pachuca measuring 12 feet in diameter by 18 feet high. This step is a batch process and uranium is precipitated by neutralizing the solution with $Mg(OH)_2$. The decant is wasted, the slurry reports to the yellow cake filter.

Precipitation on the concentrated eluate is a two-step process. During the first step gypsum is precipitated by stage addition of lime and caustic soda to a series of three pachucas. The pH is adjusted to 3.5 at the third pachuca. Manual regulation of feed rate is employed at the first pachuca; reagent addition rate to the second and third pachucas is governed by a recording pH controller. The product from the third pachuca reports to a Wemco cone thickener with Dorri-Oliver mechanism. The underflow is filtered on an Eimco drum filter, repulped and returned to the leach circuit.

The overflow from the cone thickener enters the second stage of precipitation. This is carried out in a series of three 5- by 5-foot, rubber-lined agitated tanks. Caustic soda is stage added to the series of agitators; as in the first stage, control is manual at the first agitator, and automatic at the second and third agitators. The final pH is adjusted to 7.0. The slurry then is laundered to a Wemco cone thickener. The overflow returns to eluant make-up. The underflow is filtered on an Eimco drum filter. The cake contains about 50 percent moisture which is eliminated in a Proctor and Schwartz traveling grate drier. A feature of this unit is an extruder at the feed end which forces the wet yellow cake into small wet droplets or clusters before drying. This has materially reduced dust-loss of the cake. The concentrate, following drying, is drummed for shipment.

THE END

Dredge No. 2's First 50 Years— From Alaska Gold to Malaya Tin

By **C. M. ROMANOWITZ**

Pacific Tin Consolidated Corporation's Dredge No. 2, no doubt the oldest dredge in the world that is still operating efficiently, is now located on a property near Kuala Lumpur, Malaya.

Originally this dredge was known as Dawson No. 5 of the Yukon Gold Mining Company for whom it was manufactured by the Bucyrus-Erie Company as its dredge No. 190. It commenced operation on Bonanza Creek in the Klondike on September 14, 1908, and operated only one season, recovering gold in bonanza quantities, before it was dismantled and rebuilt to continue the recovery of gold from ground that was thawed by steam. The operation of the several dredges owned by Yukon Gold Mining Company in the Yukon gold country, as well as the operation of dredges in Oregon and California, was under the management of the late Colonel O. B. Perry, one of the pioneers of the placer dredge industry.

After World War I, the Yukon Gold Company became interested in Malaya's tin ore placers, and moved Dawson No. 5 from the frozen north to Malaya's tropics. There it was rebuilt and began the recovery of tin ore at Kuala Lumpur in 1923 as Dredge No. 2.

This was joined in operation by another dredge from California—then later by two other dredges: one, another Bucyrus dredge, also from the Klondike; and one from California. The above two California dredges were designed in 1915 by the writer while with the Natomas Company at Natomas, California, and were manufactured by the Marion Steam Shovel Company for operation on California's Yuba and Trinity rivers.

When the Yukon Gold Company moved its dredges to Malaya and devoted its energies to tin ore mining, it changed its name to Pacific Tin Consolidated Corporation to meet the requirements of the New York Stock Exchange where it had been listed since 1906.

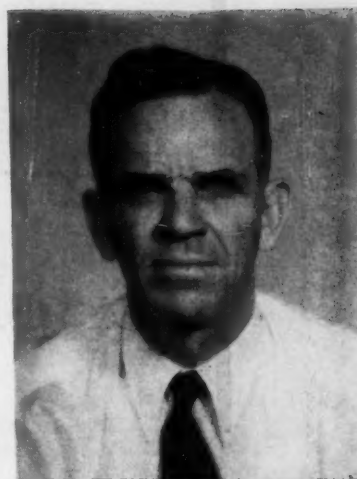
This Dredge, No. 2, has played and

still plays an important role in the development of the modern dredge in Malaya to meet the peculiar conditions confronting the operators, necessitating improvement of efficiency to offset the rising costs of operation and lowered quantities of tin ore found in the formation.

Early in its life at Kampar, Dredge No. 2 was equipped with jigs—the first used on Malayan dredges. Later, the clay extractor, puddler and log washers, all for clay treatment, were introduced to Malaya by this dredge, for the clay at Kampar gave as much trouble as the frozen gravel of Bonanza Creek.

Upon the approach of the invading Japanese, it was sunk in 1941. However, before hostilities ceased, the Japanese managed to refloat it and get it into operation for a sufficient time to damage the machinery seriously because of the shortage of lubricants and spare parts. Even more destructive to the dredge was the period of looting by local residents which occurred after the Japanese withdrew. However, after reoccupation, it was again refitted and completed its Kampar operations in 1954.

The above is a record of Dredge No. 2 under the management of Colonel O. B. Perry, E. E. McCarthy, and George Coffey. Norman Cleaveland took over, first as manager and then as president and general manager of Pacific Tin Consolidated. He immediately foresaw the need for further improvement for the recovery of fine tin, and decided this dredge would continue to be an experimental unit to develop his ideas. Norman Cleaveland has had many years of dredging experience in various dredg-

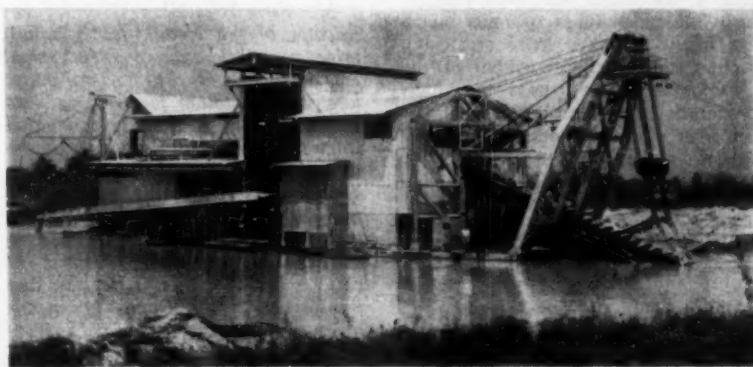


NORMAN CLEAVELAND, President and general manager, Pacific Tin Consolidated.

ing operations in all parts of the world.

He reports, "Dredge No. 2 is one of the smoothest running dredges I know of, and is still in the lead in some phases of dredge design." It was the first dredge in Malaya to use three jig cells in the flowline instead of four, and as the result of this experience, accepted the writer's recommendation that the treating system for his newest dredge, known as No. 8, now under construction, make use of two cells in a flowline which, no doubt, will eventually be standard for Malayan jiggling practice in the future as it is in California.

Also, he recently modified the drives of the Pan American jigs on this dredge to provide a 2-inch stroke at 62 revolutions per minute, and is not using an artificial bedding, all of which is again something new. This procedure has been tested about a year now on this dredge and Norman Cleaveland is convinced that it provides a more efficient jiggling for the conditions as found in Malaya.



DREDGING HISTORY from Alaska gold to Malay tin has been made by Pacific Tin's No. 2 dredge. It was the first to use jigs in Malaya, the first to use three jigs in the flowline, and the first to use no artificial jig bedding.

Mr. Romanowitz is Ellicott Machine Corporation's division sales manager of the Pacific Coast, San Francisco, California. Ellicott is the successor to the floating dredge business of the Bucyrus-Erie Company and offers complete engineering, sales, and repair part service.

Why Germans Crush Potash by Impact

By Dipl. Ing. KURT SCHMIDLAPP

As the agricultural use for potash fertilizers has grown the potash mining and milling industry has expanded to meet this demand. Expansion of production has focussed attention on crushing methods to preserve the mineral grain structure and at the same time achieve dust-free operating conditions.

In the hot solution process, the crushing of hartsalt¹ and sylvite (KCl) to 4 millimeters is usually carried out in three stages. Carnallite, $H(KCl \cdot MgCl_2 \cdot 6H_2O)$ which is processed more rarely, can be reduced to 8 mm in two stages. While in all reduction processes the object is to produce no more fines than are present in the original feed, disc and cross beater mills, which are capable of accomplishing high ratios of reduction, can be used unhesitatingly to crush crude salt down to 3-mm Kainit² trade specification and, to a still greater extent, to Hederich-Kainit³ trade specification with 80 percent of minus-0.5-mm and 50 percent of minus-0.2-mm. Since nearly all mills are vulnerable to tramp iron occurring in the crude salt, (and particularly the older types of mills which are likely to suffer more seriously), factors such as improvement of the crushing equipment used in potash preparation and simplification of the conveyor system—coupled with a decrease in the number of stages of crushing—are of vital importance. Also associated with these factors are the more exacting requirements arising from the need for the crude salt

to be reduced to flotation size. For example, German sylvite requires crushing to a size varying from 0.75 to 1.0 mm and hartsalt to a size range of 0.06 to 0.6 mm. With unfavorably interspersed hartsalt, however, reduction is limited to 0.45 mm,



Mr. Kurt Schmidlapp is managing director of the Neuhoef-Ellers potash mine—a subsidiary of Wintershall A.G.—which was the first to adopt large-scale flotation for treating kieserite-bearing hartsalt. He graduated from the Technical College at Karlsruhe, having majored in chemical engineering. He began his long association with the potash industry in 1938, with Wintershall A.G., and successively held important positions at various potash mines. Later, he was transferred to the Company's head-office at Kassel where he was actively engaged in planning and developmental work relating to hartsalt flotation and kieserite utilization.

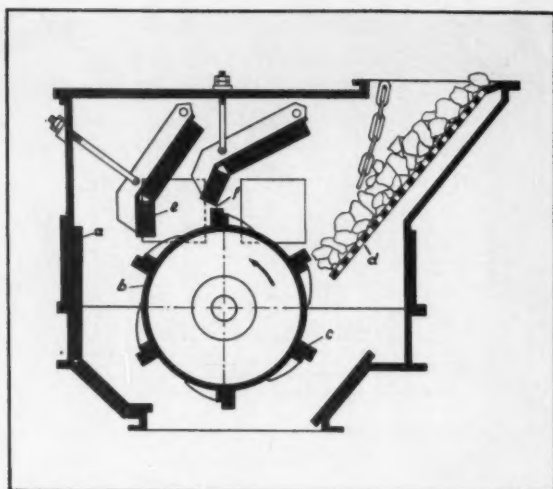
with as little undersize, minus-0.06-mm, as possible since these slime-forming and nonselectively floating components considerably hamper the flotation process.

With these considerations in mind, it is no longer a matter of surprise that the metallurgical engineer was finally compelled to check which of the crushers available from specialized manufacturers would best fill the needs. Among the conventional types of machines, particular interest was attached to the impact crusher built by Messrs. Hazemag in Münster/Westphalia, Germany, on an entirely new principle. As has been positively proved, both experimentally and in numerous large-scale installations, this crusher covers a wide field of application, embracing not only the old treatment methods based on the difference in the solubility of the various components, but also separation by flotation. In addition, the Hazemag unit has earned a reputation for unequalled reliable and economical work, even in underground application. Today, in numerous large mills, impact crushers are a familiar sight in all stages of crushing. Not only for primary and secondary reduction, but also, to some extent, for dry fine crushing. In the past, reduction to flotation size relied more or less generally either on high speed dry, or wet-operating impact disk mills, a comparatively recent contribution by Pallmann/Zweibrücken, or on rod-mills which, well proven for hartsalt and sylvite, operated in conjunction with spiral classifiers.

The Hazemag impact crushing technique is already documented by literature in Germany (selected references are given at the end of the article, 2, 3, 7, 9, 10, 12, and 14).

The results of test work carried out by mining establishments in West Germany, in particular by Wintershall

1. Hartsalt, Kieserite-bearing crude salt. (Kieserite is $MgSO_4 \cdot H_2O$).
2. Kainit, crude salt used as a fertilizer without processing, containing a certain percentage of magnesium sulphate; originally a potassium mineral.
3. Kainit-Hederich, crude salt as before, but pulverized; used to kill weeds, in particular charlock (*raphanus raphanistrum*).



IMPACT CRUSHERS. The drawing shows construction details of a top-feed, Andreas-designed Hazemag unit. An AP 5 side-feed unit is shown with a man to give size relationship.

A.G. and Burbach Kaliwerke A.G., are in agreement with those obtained in other branches of industry.^{9,12} Consequently, the principal theme of this article is to present design and operational data on Hazemag impact crushers in service above and below ground, with particular reference to the following stages of crushing:

1. Primary crushing of crude salt for hot solution or flotation treatment.
2. Secondary crushing to the required particle size for dissolving the salt or to crush to Kainit trade specification, including medium-stage crushing for flotation treatment.
3. Selective crushing.
4. Fine reduction to flotation size.

The impact crushers, nearly all of Hazemag design, reviewed in the first three sections are listed in Table No. I in the order of their capacity, together with specifications of interest.

Principle of Operation

The impact crushing principle is actually simplicity itself. Fed to the inclined perforated chute plate inside the amply dimensioned feed opening, the crude salt is caught by the motor-powered rotor provided with blow bars, by which it is thrown against the gravity hung impact plates suspended pendulum fashion inside the large-sized crushing chamber. These plates can be adjusted easily from the outside during operation. Striking these plates with great force, the crude salt is split along its natural cleavage lines. Separation takes place at the grain boundaries, and at all weak spots in the structure due to natural cleavage, loose cementing,

heterogeneous, and cracks.

In the grinding systems used hitherto (e.g. hammermills and Titan crushers), size reduction was effected by compression, bending, and shearing, with the result that the material was squeezed or beaten through screens or grates until it left the machine with the required top grain fineness; this resulted in an undesirably high proportion of fines. By contrast, impact crushers are capable of accomplishing at the same time a greater and grain-preserving size reduction by merely utilizing the kinetic energy developed according to the equation:

$$E = \frac{mv^2}{2}$$

where m = mass of the accelerated material, and

v = speed of the accelerated material.

The degree of crushing is defined as the ratio d_1/d_2 of the mean grain size (to be read off the Size Distribution Curves in the Rosin-Rammler-Bennett (RRB, Net) before and after reduction. As the degree of crushing is directly proportional to the mass "m," it follows that the already fine grain sizes undergo little or no further reduction through impacting.

In connection with the aforementioned

tioned four stages of crushing in use for potash preparation, some of the experimental and operational data on hand about impact crushing follow.

Primary crushing is principally carried out underground to break down the rock to a size suitable for hoisting in order to facilitate servicing and to better utilize the capacity of the skips. Due to the large lumps of blasted rock, the primary crusher has a throughput capacity in excess of that planned for the rest of the plant circuit. Where previously jaw or hammer crushers were used in this stage of operation, preference is now given to AP 5 heavy-duty impact crushers, as is the case at the Herfa-Neurode underground potash mine of the Wintershall A.G. Rated at 300 tons per hour, these crushers reduce the salt in one pass down to minus-4-mm with maximum of 2 percent of minus-0.3-mm fines and with complete elimination of minus-0.06-mm dust particles. Before passing into the crusher, the salt extracted in the range between an average of 100 mm and top size lumps is scalped by grizzly bars set at a 50-mm spacing.

The curves in diagram "Primary Crushing of Hartsaltz" show the original feed (a) plotted against the product from the AP 5 Hazemag impactor (b). In the fine fraction range, the

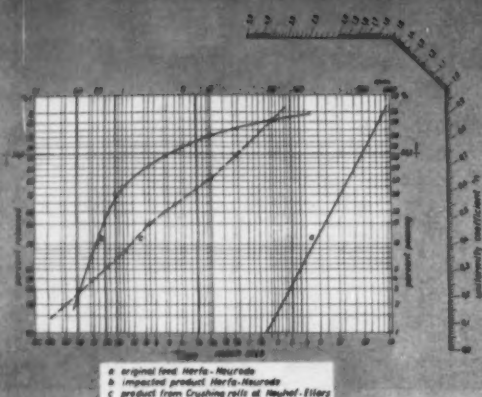
Table No. I

Characteristics of Some European Primary and Secondary Impact Crushers

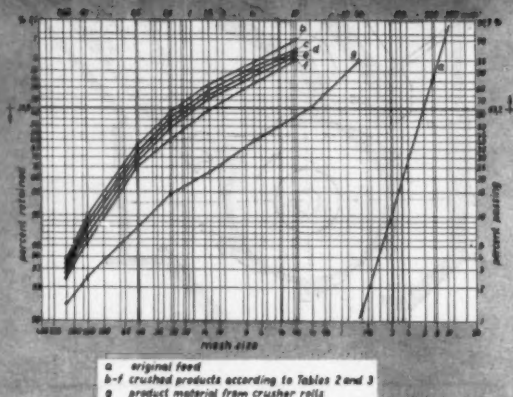
Manufacturer and Number	Throughput in Tons Per Hour ¹	Kilowatts Power Required ¹	Feed Opening Total Weight in				
			Millimeters	Kilograms	Length	Width	Height
Hazemag AP 0	2—6	4—10	190 × 270	1,000	1,300	1,100	1,000
Hazemag SAP 2	6—18	12—30	350 × 650	3,300	1,850	1,750	1,590
Hazemag SAP 4	10—50	25—50	520 × 790	5,000	2,100	1,950	2,030
Wedag G	50—100	25—50	460 × 900	8,000	2,240	2,160	1,630
Hazemag AP 4 br.	100—150	50—80	800 × 1,460	11,000	2,840	2,840	2,375
Hazemag AP 5	80—250	60—150	1,185 × 1,520	23,500	3,000	3,360	3,280

1. Depending on the properties of the material and the desired size of product.

Primary Crushing of Hartsaltz



Size-Distribution Curves in the Rosin-Rammler-Bennett (RRB) Net



latter curve is seen to run sharply upward, which is considered desirable. By comparison, curve (c) shows the performance of the large crushing rolls operating at Neuhof-Ellers (underground) on exactly the same feed. Equipped with two, 1,250-mm diameter fluted rolls, this machine has a reduction ratio of 22 to 1 at a throughput rate of 150 to 200 tons per hour with, however, a proportion of superfines (as shown by the less steeply rising curve) in excess of that obtained from the impactor. The Hazemag, with a reduction ratio of 150 to 1, has a specific power consumption of 0.58 kilowatt-hours per ton.

At a large-scale pilot-plant installed at the Hildesia mine (Wintershall A.G.), a series of interesting tests were carried out on an SAP 2 Hazemag as a primary impactor (see Table No.

I), as well as fine crushing tests on various types of high-speed mills in general and on an FAP 1 Hazemag fine crushing impactor in particular. The SAP 2 primary impactor incorporated a 715-mm diameter by 670-mm face rotor and was fed with run-of-mine salt broken down by pneumatic jack hammers to a 30 to 300 mm size, with an oversize analysis of 165 mm. This material was crushed in one pass, with ratios of reduction related to various speeds and gap distances (distance between the blow bars and—as a rule—the rear impact plate). The test results obtained from the SAP 2 unit with a circumferential speed of from 20 to 32 meters per second are shown in Table No. II, whereas those based on various gap distances are listed in Table No. III. (See Size-Distribution Curves Diagram.) Likewise, the latter

figure shows by comparison the curves drawn for crusher-rolls fed with a material of similar characteristics.

The influence of the gap distance on the degree of size reduction plotted at the two circumferential speeds of 20 and 32 meters per second, can be further clarified by examination of Degree of Size Reduction As Function of Rear Gap Spacing Chart from which it is seen 1) that the degree of size reduction is greater as the gap distance is narrowed, and 2) that the effect of closing the gap is roughly constant for the different rotor speeds.

Secondary Crushing

As the impact crusher used in the primary stage delivers in one pass a product reaching, via the medium crushing-stage, well into the high fineness range, it was only logical to also use it for fine crushing sylvite and Kainit down to finished product size, i.e. minus-4-mm, thereby combining primary, secondary and, partially, tertiary crushing in a single operation. The oversize is recirculated for further reduction. Large-scale mills working on this principle were set up in the Wintershall A.G. and Burbach Kaliwerke A.G. Group. The Hazemag model AP 4 Br. is used as a standard mill for treating potassium salts at the Hildesia mill where crude salt and Kainit are reduced by one AP 4 Br. impactor in closed circuit from lump size to minus-3-mm; and at the Neuhof mill, where precrushed hartsaltz is also crushed to 50 percent minus-0.6-mm by one AP 4 Br. unit. At Neuhof, however, crushing is in open circuit, with the oversize recrushed in a smaller SAP 4 Hazemag impactor.

The Sieve Analysis Chart is plotted from data obtained at the Riedel mill.

Table No. II

Analysis of Crushing Tests With SAP 2 Impactor Performed with 15/5-Millimeter Gap Distance at Various Circumferential Speeds

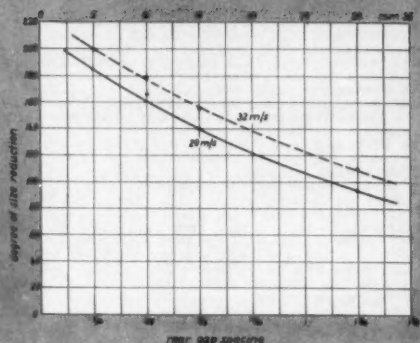
Circumferential Speed of Rotor Size Distribution Curve Diagram	20 Meters Per Second		32 Meters Per Second	
	weight percent	percents added	weight percent	percents added
> 4.0 mm	8.0	8.0	6.5	6.5
1.5 — 4.0 mm	13.7	21.7	12.0	18.5
1.0 — 1.5 mm	9.2	30.9	9.8	28.3
0.6 — 1.0 mm	12.7	43.6	11.9	40.2
0.3 — 0.6 mm	23.0	66.6	23.5	63.7
0.1 — 0.3 mm	24.8	91.4	26.8	90.5
0.06 — 0.1 mm	5.4	96.8	5.9	96.4
< 0.06 mm	3.2	100.0	3.6	100.0

Table No. III

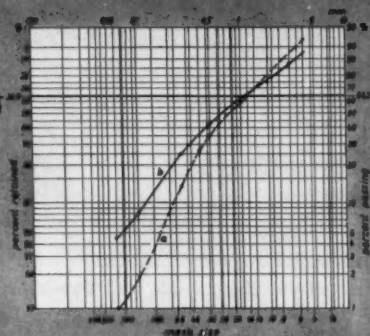
Analysis of Crushing Tests With SAP 2 Impactor Performed at 20 Meters Per Second Circumferential Speed and Various Gap Distances.

Gap Distance Millimeters	Millimeters Average Size Of Grain Feed	Millimeters Crushed Product	Degree Of Size Reduction	Weight Minus 0.6 Millimeters	Weight Minus 0.06 Millimeters	Energy Input Kilowatt Hours Per Ton	Particle Size Distribution Curve In RRB Net
15/ 5	165	0.9	185:1	56.4	3.2	0.68	c
20/10	165	1	165:1	52.0	3.0	0.67	d
25/15	165	1.2	138:1	48.0	3.0	0.62	e
30/30	165	1.8	92:1	41.0	2.5	0.60	f

Degree of Size Reduction as Function of Rear Gap Spacing Chart



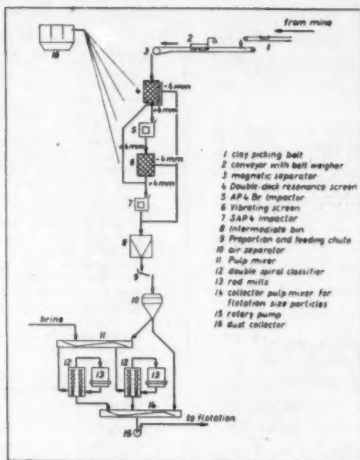
Sieve Analysis Chart



a AP 4 Br. Impactor in closed circuit (operating at 34 m/sec and 10/8 mm setting)
b Hazemill of equal throughput capacity

Here sylvite is crushed by an AP 4 Br. Hazemag impactor down to the required particle size for dissolving the salt. This closed-circuited impactor performs primary, secondary, and finishing reductions all-in-one, constituting a crushing plant characterized by its simplicity, reliability, and economy. For comparative purposes, the chart also shows the performance curve for a hammermill of equal throughput capacity. Many of the same considerations apply to the Kainit impactor at Hildesia. As will be appreciated from reference to Table No. IV, the energy consumption figures for this impactor are at a relatively low level. In larger crushing plants, they are still more favorable.

The sequence of operations at the previously mentioned crushing plant is shown in the Neuhoef-Ellers mill flowsheet. Crushing rolls are used underground to break the hartsaltz to the size necessary for the removal of the accompanying clay by handpicking. The precrushed material is then reduced above ground to about 4 mm, which is the required particle size for secondary dry crushing. In this secondary stage by impact crushing up to 50 percent minus-0.6-mm is produced by one AP 4 Br. Hazemag impactor. At the same time, the oversize is crushed and the dry product—prior to grinding in the wet rod mill



Flowsheet, Neuhoef-Ellers Crushing Plant

—is classified (in an air separator) into minus-0.6-mm flotation grain, and grit, the latter going to the wet grinding section.

By separating the crushing plant into two sections, one arranged for dry impact crushing which, as stated previously, gives a product already reduced to fine sizes, and the other for operating wet, it is possible, with the air separator properly adjusted, to proportion the minus-0.6-mm product so as to form with the classifier overflow a slurry of constant density, such as is suitable for flotation (German Patent 951,441).

Energy data based on a throughput capacity of approximately 225 tons per hour are given in Table No. V. However, higher throughputs have been readily achieved; the rate of extraction was increased from 2,000 to 4,000 tons per day, as both the impactors and the screens (reso-

Table No. V
Energy Consumed by Impactors at Neuhoef-Ellers Mill

	AP 4 Br. Impactor	SAP 4 Impactor
THROUGHPUT (tons per hour)		
Normal	150	50
Average, day measured	90	26
DRIVING POWER (kilowatts)		
Rated	100	50
Average, day measured	43	36
ENERGY CONSUMED (kwhr per ton)		
Crushed salt	0.48	1.38
Total extraction	0.19	0.19
POWER UTILIZATION (Percent)		
Electric	43	59
Mechanical	60	52

nance screens Flämrich-Recklinghausen) have a throughput capacity greatly in excess of that planned originally. Due to their high invulnerability to tramp iron and overloads, the Hazemag impactors are giving troublefree service even during their fourth year of operation, with remarkably low wear rates of blow bars, this in spite of the abrasive nature of the hartsaltz being handled by these machines.

By comparison, the wear rates experienced on a hammer mill when applied to the same kind of work will be extremely high, with frequent periods of down-time, mainly due to the grates.

Watch for Part II, "How to Crush Potash by Impact," which outlines tests which indicated that dry impact crushing followed by wet rod milling with oversize returned to impact disc mills was most profitable method of crushing and grinding before flotation. In practice, doubling of milling capacity without major equipment additions was possible.

Table No. IV
Energy Consumed at Hildesia
Crushing Plant

Type of Salt	Kilowatt Hours Per Ton Crushing Plant Including Conveyors	Impactor Alone
Trade quality	1.20	0.36
Kainit	1.24	0.37
Hartsaltz for flotation salt	1.18	0.35



HYDRO-LOK gel was pumped into rock through these pipes.

New Polymeric Water Gel Used To Seal Water-Bearing Fissures

A new method of sealing underground water-bearing fissures and formations using a polymeric water gel has proved successful in a mined cavern for butane storage and in vertical mine shafts. These initial uses by the mining industry point to widespread applications.

The gel, marketed by Halliburton Oil Well Cementing Company under the name, Hydro-Lok "PWG," works by penetrating the capillaries of a water-bearing formation. Its initial viscosity is almost as low as that of water, which aids its entry into a formation.

Sun Oil Company while excavating the nation's first butane storage cavern in granite at its Marcus Hook, Pennsylvania, refinery encountered a small amount of water from two fault zones and seepage from many small fissures.

The problem was referred to Sun's Dallas, Texas research laboratory. Researchers there suggested that the Halliburton water control materials—one of which is the polymeric water gel—might be the answer. A conference was arranged among Sun personnel; representatives of Fenix & Scisson, Inc., mining contractor for the excavation; and Halliburton chemical engineers. At the meeting it was agreed that the gel would be tested on a trial basis. After a few applications the idea proved practical and Sun approved completion of the project.

The gel and a special resin cement were used for the treatments—the cement was employed as a bulking agent when spaces were large enough to require filling prior to sealing. The two materials were mixed in batches within the cavern, 306 feet below the surface. Holes six to 32 feet deep were drilled to intersect the water-bearing fissures; packers were then set in the holes, and the water control agents were squeezed in and held under pressure. Injection pressures ranged from 400 to 1,200 pounds per square inch. Setting time of the gel was adjusted to vary from eight minutes to one hour.

After 33 working days, more than 95 percent of the water seepage had been stopped. This reduced the intrusion to a measured rate of less than 0.5 gallon per minute. Some 600 treatments were made, varying from three to 800 gallons each. A total of 7,946 gallons of gel and 736 gallons of resin cement were consumed.

The gel's success at the butane storage cavern was preceded by a shaft sealing job. Two large shafts in Morton Salt Company's Fairport Harbor mine at Painesville, Ohio were sunk through a sandstone formation producing gas at 700 pounds per square inch pressure and flowing a very salty brine. Several gel treatments corrected this condition and left the shafts completely dry and without gas.

U.S.A. Metal & Mineral Prices

METALS

JANUARY 16, 1959

COPPER: Electrolytic, Delivered F.o.b. cars, Valley basis (pound)	29.00¢
Lake, Delivered, destinations, USA	29.00¢
Foreign, Delivered Destinations, USA	29.00¢
Custom	29.50¢
LEAD: Common Grade, New York (Per pound)	13.00¢
Tri-State Concentrate, 80% lead, per short ton	\$156.12
ZINC: Prime Western: F.o.b. E. St. Louis (Per pound)	12.00¢
Prime Western: Delivered, New York	\$16.75
Tri-State Concentrate, 60% zinc, per ton	\$68.00
ALUMINUM: Primary 30 Pound Ingots (99% plus) (Per pound)	26.80¢
ANTIMONY: Lone Star Brand, F.o.b. Laredo, in bulk (Per pound)	29.50¢
BISMUTH: (In ton lots) price per pound	\$2.25
CADMIUM: Sticks and bars, 1 to 5 ton lots (Price per pound)	\$12.45
COBALT: 97.99%, keg of 550 pounds (Price per pound)	\$2.00
COLUMBIUM: Powder	Nom., per pound \$55.00-\$85.00
GERMANIUM: Germanium dioxide, high purity, gram	18.50¢
LITHIUM: 98% (per pound)	\$11.00-\$14.00
MAGNESIUM: Ingots (98.8%) F.o.b. Valasco, Texas, per pound	36.00¢
MERCURY: Flasks, Small lots, New York	\$218.00-\$222.00
NICKEL: "F" Ingots (5 pounds), F.o.b. Port Colbourne, Ontario	75.50¢
PLUTONIUM: To July 1, 1962 AEC will pay \$30.00 to \$40.00 per gram depending on plutonium 240 content. July 1, 1962 to June 30, 1963, per gram	\$30.00
SELENIUM: 99.5%, per pound	\$7.00
THORIUM: per kilogram	\$43.00
TIN: Grade A Brands, New York (Per pound) Prompt delivery	\$9.125¢
TITANIUM: 99.3% + Grade "A" Sponge (Per pound)	\$1.70-\$1.82
URANIUM: Rod (0.790 U-235) \$16.00 Per Pound; Foil	\$16.75
U-235: Nominal (Per pound)	\$7.725
GOLD: United States Treasury Price	\$35.00 per ounce
SILVER: Newly mined domestic, U.S. Treasury price per ounce	90.5¢
Foreign Handy Harmon	90.7¢
PLATINUM: Per ounce	\$52.00-\$55.00
ZIRCONIUM: Sponge, Per pound, Reactor Grade	\$5.00

ORES AND CONCENTRATES

BERYLLIUM ORE: 10 to 12% BeO, F.o.b. mine, Colorado \$46.00 per unit	
Small lot purchase of Custer, S. D., Spruce, Pine, N. C., and Franklin, N. H. Visual inspection at \$400.00 per short ton or by assaying at: 8.0 to 8.9% BeO, \$40 per unit; 9.0 to 9.9%, \$45; over 10.0%, \$48.00.	
CHROME ORE: F.o.b. railroad cars eastern seaports. Dry long tons	
African (Rhodesian), 48% Cr ₂ O ₃ , 3 to 1 Ratio	\$44.00-\$45.00
African (Transvaal), 48% Cr ₂ O ₃ , No ratio	\$31.00-\$33.00
Turkish, 48% Cr ₂ O ₃ , 3 to 1 chrome-iron ratio	Nominal \$50.00
U.S. Government ore-purchase depot Grants Pass Oregon. Buying suspended, quota filled.	
COLUMBIUM-TANTALUM ORE: Per Pound Pentoxide Nominal \$1.00	
IRON ORE: Lake Superior, Per gross ton Lower Lake Ports	
Mesabi, Non Bessemer, 51.5% Fe	\$11.45
Mesabi, Bessemer, 51.5% Fe	\$11.60
Old Range Non Bessemer	\$11.70
Old Range Bessemer	\$11.85
Swedish, Atlantic Ports, 60 to 68% Fe Contracts, Per Unit	\$26.00¢
MANGANESE ORE: Metallurgical grade, 48 to 50% Mn. Long ton unit	\$1.00-\$1.05
Metallurgical grade, 46 to 48% Mn. Long ton unit	\$0.95-\$1.00
Metallurgical grade, 44 to 46% Mn. Long ton unit	\$0.85-\$0.90
Domestic U.S. Government purchasing depots: Butte, Mont.; (black and pink ore) base price of \$4.87 per long dry ton of 18% manganese ore, Phillipsburg, Mont.; base \$6.43 per long ton of 15% manganese ore. Small lot program f.o.b. railroad cars, minimum 40%.	
Base (48%) \$2.30 per unit with premiums and penalties.	
MOLYBDENITE CONCENTRATE: 90% MoS ₂ , F.o.b. Climax, Colorado, Per pound Mo, plus container cost	\$1.25
TUNGSTEN CONCENTRATE: Domestic, 60% WO ₃ , Per short ton unit	Nominal \$21.00
Foreign, 65% WO ₃ , Per short ton unit (Scheelite)	Nominal \$14.00
Foreign: South American, Spanish, Portuguese	Nominal \$13.00
URANIUM ORE: F.o.b. purchase depot or company mill in accordance with AEC schedules and company buying contracts. Basic price is \$1.50 per pound of U ₃ O ₈ in ore assaying 0.10 percent. For each additional 0.01 add 20¢. Subject to development allowance, premiums, penalties where applicable.	

NON-METALLIC MINERALS

BARITE: Oil well drilling, Minimum 4.25 specific gravity, per short ton	\$16.00
BENTONITE: Minus-200-mesh, F.o.b. Wyoming, Per ton, car-load lots	\$12.50
Oil Well grade, Packed in 100 pound paper bags	\$14.00
BORON: Technical grade	\$47.50
F.o.b. Boron, California, Per ton	
FLUORSPAR: Metallurgical grade, 72.5 % effective CaF ₂ content per short ton F.o.b. Illinois-Kentucky mines	\$36.00-\$40.00
Mexican, 70% F.o.b. border	\$26.00-\$27.00
Acid Grade, 97% CaF ₂ , Bulk, F.o.b. mine	\$48.00-\$52.00
Government buying F.o.b. producer's shipping point: 60% Illinois-Kentucky, \$34.50 per ton, others \$28.50; 70% Ill.-Ken. \$38.50, others \$32.50.	
PERLITE: Grades F.o.b. mine per short ton	\$3.00 to \$5.00
Plaster grades, Crushed and sized, F.o.b. plants	\$7.00 to \$9.00
SULPHUR: Long ton, F.o.b. Hoskins Mound, Texas	\$25.00
Export	\$24.00-\$25.00

LONDON METAL AND MINERAL PRICES

January 16, 1959

	Per Long Ton	USA Equivalent cents
		per pound
COPPER: Electrolytic spot	\$229	15s 6d 28.72¢
LEAD: Refined 99%	\$72	12s 6d 9.08¢
ZINC: Virgin, 98%	\$76	5s 0d 9.53¢
ALUMINUM: Ingot, 95.5%	\$180	0s 0d 22.50¢
ANTIMONY: Regulus, 99.6%	\$197	10s 0d 22.69¢
TIN: Standard, 99.75%	\$757	0s 0d 94.63¢
TUNGSTEN: Long ton unit	\$95	\$13.30
1. With Stealing		Pound of \$2.80
Quotation on metals and certain ores through the courtesy of American Metal Market, New York, N. Y.		

Nothing fits **STRIP MINING**

like this fast, mobile 6-yd. diesel-powered

MANITOWOC!

See how this heavy, far-reaching Manitowoc Model 4500 dragline works right at the edge of the cut. That's real stability, paying off in full buckets with every pass. With a 120 ft. boom matched to a big 6-yd. bucket, your operator can remove more overburden from one spot with less frequent machine moves. ■ Added to this tremendous reach and capacity you get power to spare... supplied by the most simple, efficient drive in the industry. Job proven diesel power lets you work anywhere, unhampered by a trailing cable and expensive electric power installations. Plus benefits include a realistic initial cost, simple maintenance, fast disassembly for rail or trailer shipment; convertibility to a 5½-yd. shovel and a high trade-in value. ■ A call to your Manitowoc distributor will bring all the important details... contact him now for information on earliest delivery.



Manitowoc

MANITOWOC ENGINEERING CORP., Manitowoc, Wisconsin

(A subsidiary of The Manitowoc Company, Inc.)

CRANES 20 ton - 100 ton • **SHOVELS** 1-yd. - 5½-yd.

27ton

"EUC" REAR-DUMP

*It's new...but
JOB PROVED!*



325 or 335 h.p. . . . Torqmatic Drive . . . 18.00 x 25 tires

Model R-27 is a new size in the complete line of Euclid Rear-Dumps—rated payload is 54,000 lbs. This off-highway hauler incorporates the job-proved components which have made Euclid Rear-Dumps the outstanding choice of contractors, mines and quarries.

With either 325 h.p. GM diesel or 335 Cummins engine, Allison Torqmatic Drive makes maximum use of the power for faster hauling cycles. Converter lock-up in the 4-speed Torqmatic permits 34 mph speed with full payload and efficient performance on long, high speed hauls.

Standard 18.00 x 25 tires on all four wheels assure the traction and load carrying capacity needed for moving 27-ton payloads on tough hauls. Standard body is rated at 18 cu. yds. struck—quarry type body is also available. The R-27 is equipped with oil retarder for safer, more economical braking on jobs with steep down-grades on the loaded haul.

See your Euclid dealer for detailed specifications on this new 27-ton Rear-Dump . . . it's a good example of the advanced design that makes Euclid your best equipment investment.

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

**A complete line of Rear-Dumps—10, 15, 18, 22, 27, 40 and 50 ton capacities,
also semi-trailer models of 12, 22 and 35 ton payload—to fit any job.**



EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

United States

Personalities in the News

D. G. McMullen, former assistant mining superintendent at International Minerals & Chemicals Corporation's Noralyn mine in Florida, has been appointed mine superintendent. W. C. Cross has been named assistant superintendent at Noralyn.

James W. Townsend, Denver mining engineer, has been appointed executive officer of the office of Minerals Exploration Field Team in Region III, which includes the Dakotas, Wyoming, Nebraska, Utah, Colorado, Arizona and New Mexico.

C. N. Holmes, director of strategic minerals section, and D. E. Fryhofer, land assistant to the director, have been transferred from the Salt Lake City, Utah office of Phillips Petroleum Company to Bartlesville, Oklahoma, where the company's exploration division recently has been moved.

Dr. Frank R. Hunter has been appointed chief geologist in the mining and exploration department of International Minerals & Chemicals Corporation at Carlsbad, New Mexico.

George F. Weaton, Jr. has been appointed director of Ore Reserves Estimates for the School of Mines and Metallurgy of the University of Minnesota.

Stanley W. McDougall retired as manager of the Kellogg (Idaho) operations for the Bunker Hill Company at the first of the year. He will continue to serve Bunker Hill as a mining consultant on a part-time basis.

Raymond G. Thompson, superintendent of Garfield smelter—former American Smelter & Refining Company operation, will continue in this capacity for Kennecott Copper Corporation's Utah Copper Division. Kennecott's purchase of the smelter was effective January 1, 1959.

Recent International Minerals & Chemicals Corporation appointments to the new Research, Engineering and Development Division in Skokie Illinois are: H. Turner Loehr, director of engineering; Lawrence A. Roe, director of development; and Walter L. Hardy, manager of chemical research. Mr. Loehr and Mr. Roe were associated with IMC prior to their recent



The American Institute of Mining, Metallurgical, and Petroleum Engineers recently made its first presentation of the Hal Williams Hardinge Award. It was made posthumously to Dr. Oliver Bowles, former chief, non-metallic economic division, U.S. Bureau of Mines. Dr. Augustus B. Kinzel (left), president of AIME, made the presentation to Mrs. Eva W. Bowles in the presence of her sons, George and Edgar. The plaque cited Dr. Bowles for "signal service in the field of industrial minerals." Mr. Hardinge was a noted inventor and manufacturer of mining and mill equipment. The award was established by his widow, Mrs. Bertha W. Hardinge.

appointments, and Mr. Hardy has been assistant to the president of Foster D. Snell, Inc., New York for the past two years.

James J. Dougherty, assistant superintendent of smelting at the Anaconda Company's Anaconda Reduction Works, has been named chairman of the Montana Section, American Institute of Mining, Metallurgical and Petroleum Engineers. He succeeds Edward P. Shea of Butte, Montana, Geologist for the Anaconda Company. Also elected to office were: George T. Hanson, control engineer at Anaconda Aluminum Company, vice chairman; Koehler Stout, assistant professor of mining engineering at Montana School of Mines, secretary-treasurer; and Guy T. Wever, John R. Moore, and Clifford J. Hucks, executive committee.

Duncan MacDonald has been promoted to fill a newly created position of personnel director at the Anaconda Reduction Department of the Anaconda Company. Mr. MacDonald was previously coordinator of communications of the Western operations for the company.

A. P. Morris, general manager of Ray Mines Division, Kennecott Copper Corporation, Ray, Arizona, was reelected chairman of the Arizona Section, American Institute of Mining Metallurgical, and Petroleum Engineers. Other officers elected were: W. C. Lawson, manager of western operations of Phelps Dodge Corporation, first vice president; T. A. Snedden, western mining department, American Smelting & Refining Company, second vice president; and C. L. Hoyt, Ray Mines Division, Kennecott Copper Corp., secretary-treasurer.

Willis M. Johns was recently appointed resident geologist for the Great Northern Railway at Kalispell, Montana. His duties are a part of the program to investigate raw materials as a stimulus to industrialization of Western Montana.

Two employees of the Hayden plant of the Ray Mines Division of Kennecott Copper Corporation have been promoted. Robert G. Woods has been named grinding and flotation foreman in the Hayden concentration mill, and James L. Stevens has been named division director of quality control.

George W. Streepey has been appointed general manager of Aluminum Company of America's raw materials division, formerly called the mining division, with headquarters in Pittsburgh, Pennsylvania. Mr. Streepey joined Alcoa in 1929 following his graduation from the University of Arkansas.

Tom Kiser, president of the Wesah Mining Company, Miami, Oklahoma, has been elected president of the Tri-State Zinc and Lead Ore Producers Association, succeeding Harold L. Childress. Other association officers who were re-elected are O. A. Rockwell, vice president and general manager, Eagle Picher Company, vice president; H. G. Wiedman, independent mine operator of Baxter Springs, Oklahoma, vice president; Ward C. Ball, local manager of American Smelting & Refining Company, treasurer; and Hugh Wright, executive secretary.

Quenton L. Brewer has recently joined H. J. Vander Veer and Associates in Salt Lake City, Utah. Mr. Brewer was formerly associated with the Defense Minerals Exploration Administration in Washington, D. C., and later served as chief of the Engineering Branch and deputy director of the Exploration Division, AEC, at Grand Junction, Colorado.

R. G. Williams, formerly senior draftsman at the Phosphate Minerals Division of International Minerals and Chemical Corporation, was recently promoted to industrial engineer.

JOHN TOWERS, JR. has been appointed manager of the Carteret, New Jersey plant of United States Metals Refining Company, a subsidiary of American Metal Climax, Inc. He succeeds Freeman H. Dyke, who recently announced his retirement after serving as plant manager from 1951 to 1958. Mr. Towers, a graduate of Michigan College of Mining, has been with United States Metals Refining Company since 1949. In 1956 he was named general superintendent of smelting and refining and for the past year served as manager of operations.



WILLIAM W. LITTLE is the new manager of the Copper Queen Branch of Phelps Dodge Corporation, which includes the mines at Bisbee, Arizona and the smelter at Douglas, Arizona. He succeeds Carl E. Mills, who retired. Mr. Little, who started with the company



in 1937 as a miner, will have his office in Bisbee. He has been mine superintendent at Bisbee, general superintendent of the United Verde Branch, and general superintendent of operations for the Copper Queen Branch. Mr. Little is a 1934 graduate of the Colorado School of Mines.

PRODUCTION EQUIPMENT PREVIEW

PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill or smelter. This PEP section is MINING WORLD's way of making available to you some of the finest current information on mechanization.



Oshkosh W-2800 Dumper Has Exhaust Heated Body

The new model W-2800 Oshkosh Motor Truck unit, carries a 30-ton payload with all-wheel-drive to provide the braking and pulling traction needed, especially for negotiating rough, muddy terrain. For use at Moa Bay Mining Co.'s new Moa Bay nickel mine in Oriente province, Cuba, a specially-designed straight-floor box, made by the Heil Co., holds 24 cubic yards, dumps at a maximum angle of 70°, and is exhaust-heated for clean dumping of the moist, sticky nickel-cobalt ore. Power is furnished by a 320 hp Cummins supercharged Diesel and the truck is equipped with Allison torque converter and power shift transmission. For additional information write to: Oshkosh Motor Truck Co., Oshkosh, Wisconsin, U.S.A.



New Two-Way Radio Requires No License

A new radiotelephone for two-way operation on the new 27 megacycle Citizen's Band is now available for you from the Gonset Division, Young Spring & Wire Corp., 801 South Main St., Burbank, California. The new Citizen's Band enables any citizen over 18 years of age to operate the unit in the United States. A license is not required, other than the filing of a simple application form.

Because of its lower frequency, this band (26.96 to 27.23 mc) can be expected to offer greatest range and reliability since it is not subject to the line-of-sight limitations of the existent 450-470 mc Citizens Band. Called the G-11 Citizen's

Communicator, the unit is a complete two-way voice transmitter-receiver and power supply in a single compact, highly portable unit. Transmitter provides 5 watts input, the maximum allowable power for this type of service. The G-11 is very stable, and operating frequency is not affected by jarring or vibration. Tuning controls are eliminated, and operation is entirely non-technical. It can be used as a hand or vehicle mounted unit. Range is from 30 to 50 miles, and price is \$149.50. To find out more about this unit write to company at above address.



A-C Extends Range Of Rubber-Lined Pumps

Allis-Chalmers has extended the capacity range of its rubber-lined pumps with the addition of a new 14 by 12-inch unit.

The new pump is designed for heads up to 140 ft at 870 rpm and capacities to 8,000 gpm. It is believed to offer the largest volume, at comparable speeds, of any rubber-lined pump yet available.

Allis-Chalmers rubber-lined pumps are handling abrasive, fine-mesh material—1/4 inch round to 325 mesh—such as sand, taconite, grinding mill discharge, tailings, silicon carbide, aluminum oxide, slimes, slurries, etc. They are available in sizes from 2 by 2 inches to the new 14 by 12-inch unit in open or closed impeller models. For additional information write company at Milwaukee 1, Wisconsin.

New Hydraulic Shovel Only 28 Inches High

A 28-inch high shovel loader has been developed by Myers-Whaley Co., Knoxville, Tenn., that now enables miners to mechanically load under extremely low-height conditions. The new machine is 16 feet long and 54 inches wide. It is crawler mounted and hydraulically operated, and has a crowding effort of 4,000 pounds, and a lifting effort on the teeth of the shovel of more than 1,200 pounds.

One of its features is its oscillating shovel action. Another is its straight line conveyor which raises to load into haulage vehicles. The conveyor also gives the

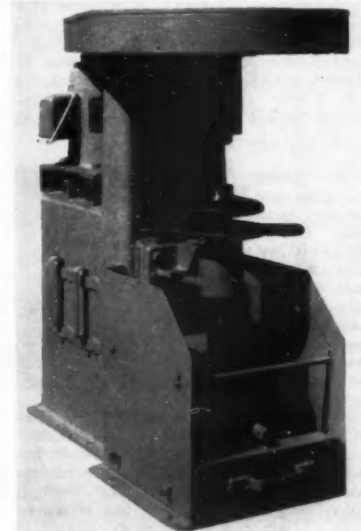


unit storage capacity, in case the shovel loader has to move out to a dumping point. Weighing about 6,450 pounds, the Whaley Low Height Hydraulic Shovel sells for approximately \$12,000. For additional information write to company at Knoxville 1, Tenn.

Pulverizer By Bethlehem Grinds to 350-Mesh

Here's a new sample pulverizer manufactured by the Bethlehem Pacific Coast Steel Corp. In operation, the mineral to be pulverized is introduced between a fixed conical ring and a rotating and gyrating conical muller. Once the mineral is ground, it drops directly into a drawer.

The new sampler has many features. According to the company, there is no loss of sample during pulverizing. All of the sample falls into a drawer. Brushing is seldom required, because the unit is virtually self-cleaning. The pulverizer will readily grind to 350 mesh, and grinding will not produce sufficient heat to ignite high-sulfur ores. A 2-hp motor powers the unit, and the grinding muller and ring are designed for long life. Purging between samples is accomplished by passing a small quantity of sharp sand through the Bethlehem Sample Pulverizer. For additional information write to company at 20th & Illinois Sts., San Francisco, California.





Automatic Trip Holder Cuts Car Manipulation Time

A new automatic trip holder for mine cars has been announced by The Nolan Company. The unit, called the Nolan Hold-A-Trip, is designed for use in conjunction with the Nolan Port-O-Trip, which automatically spots mine cars for loading. Hold-A-Trip is placed between the track rails and clipped firmly to the ties. A control hose runs from the trip holder to the pressure system of the Portafeeder. When feeder starts, oil pressure operates a cylinder on the trip holder to release the brake thus permitting cars to move. When the feeder is stopped, the trip holder brake is automatically set and the cars held immovable. For further details write the company at 2157 Euclid Ave., Cleveland 15, Ohio.



Two Completely New D8 Caterpillar Tractors

Two completely new Caterpillar D8 Tractors, both possessing increased weight, horsepower, and productive ability over their predecessors, are announced by Caterpillar Tractor Co. The new machines are the Caterpillar Series H D8 direct drive and torque converter Tractors.

The introduction of these new units culminates a 3½ year development program at Caterpillar, to make available a bigger, more powerful D8 Tractor, capable of providing more profitable operation on today's increasingly demanding construction, mining, logging and similar applications.

The increased size and power of the new units can best be seen by comparing their statistics with those of the D8s they replace in the Company's line. Weight of the new direct drive D8 is 47,102 lbs., an increase of 4,377 over the previous D8. In torque converter models, the 47,875-lb. weight of the new series H D8 is 4,480 lbs. greater than the old machine. Dimensionally, the newly-introduced D8s are 9 inches longer and 5 inches higher than their predecessors. Gauge has been increased from 78" to 84". Length of track ground contact has been increased from 111½ to 114-11/16 inches to provide adequate footing for both drawbar and front-mounted equipment applications.

The use of double reduction final drive

gearing helps provide ground clearance of nearly 20% on the new units. This represents an increase of more than 50% over the previous D8s, giving the new machine the greatest ground clearance in its size class.

Flywheel horsepower of the new units has been increased to 225 from the previous 191, an increase of 18%. Drawbar horsepower on the direct drive model is 180, increased from 155. Torque rise of the new Series H D8's engines has been increased to 20%, which provides substantially better lugging ability in coping with tough jobs. For additional information, write to Caterpillar Tractor Co., Peoria, Illinois, U.S.A.



Failing Company Develops New Rotary Drill Rig

A new portable drilling rig, especially designed for use by the mining industry has been announced by the George E. Failing Co., Enid, Oklahoma.

The rig is described as one of the most versatile ever designed by the Failing Co. Designed to drill blast holes, take cores, sample soil, the unit may also be equipped with down-the-hole equipment for drilling in very hard formations. A GF-660 Crane Carrier truck with a GMC 4-71 Diesel engine provides a mount for the Failing unit. The truck engine also furnishes power for the rotary table. A Le Roi model 100-S2 air compressor with a GMC 6031-C Diesel engine supplies the unit with air. Three hydraulic leveling jacks are standard equipment on the drill rig. Additional information is available to you by writing to the Failing Co., in Enid, Oklahoma.

FIND OUT what the new 18-ton "65" or 24-ton "95" International Harvester Pay-hauler truck can do for you. According to the company the off-highway dump unit offers fuel economy, spotting ease and fast dumping speed. Send for free descriptive booklet. Write to company at 180 N. Michigan Ave., Chicago 1, Illinois.

NEW PORTABLE BIT and drill steel grinder, designated LSB-63, is fully described in a new brochure published by Atlas Copco companies. The unit, fully described in this brochure, was developed to make on-the-job dressing of carbide tipped drill rods and bits easier. Write to Atlas Copco Pacific Inc., 930 Brittan Ave., San Carlos, California, for your copy.

Notes From The Manufacturers

C. E. "SKIP" JONES has been appointed manager of engine sales of International Harvester's Construction Equipment Division at Melrose Park, Illinois. Mr. Jones has been with International Harvester Company since 1936. He has held construction equipment posts in Quincy and Aurora, Illinois and in the Chicago general office. His last assignment was divisional supervisor of sales engineering and sales development.



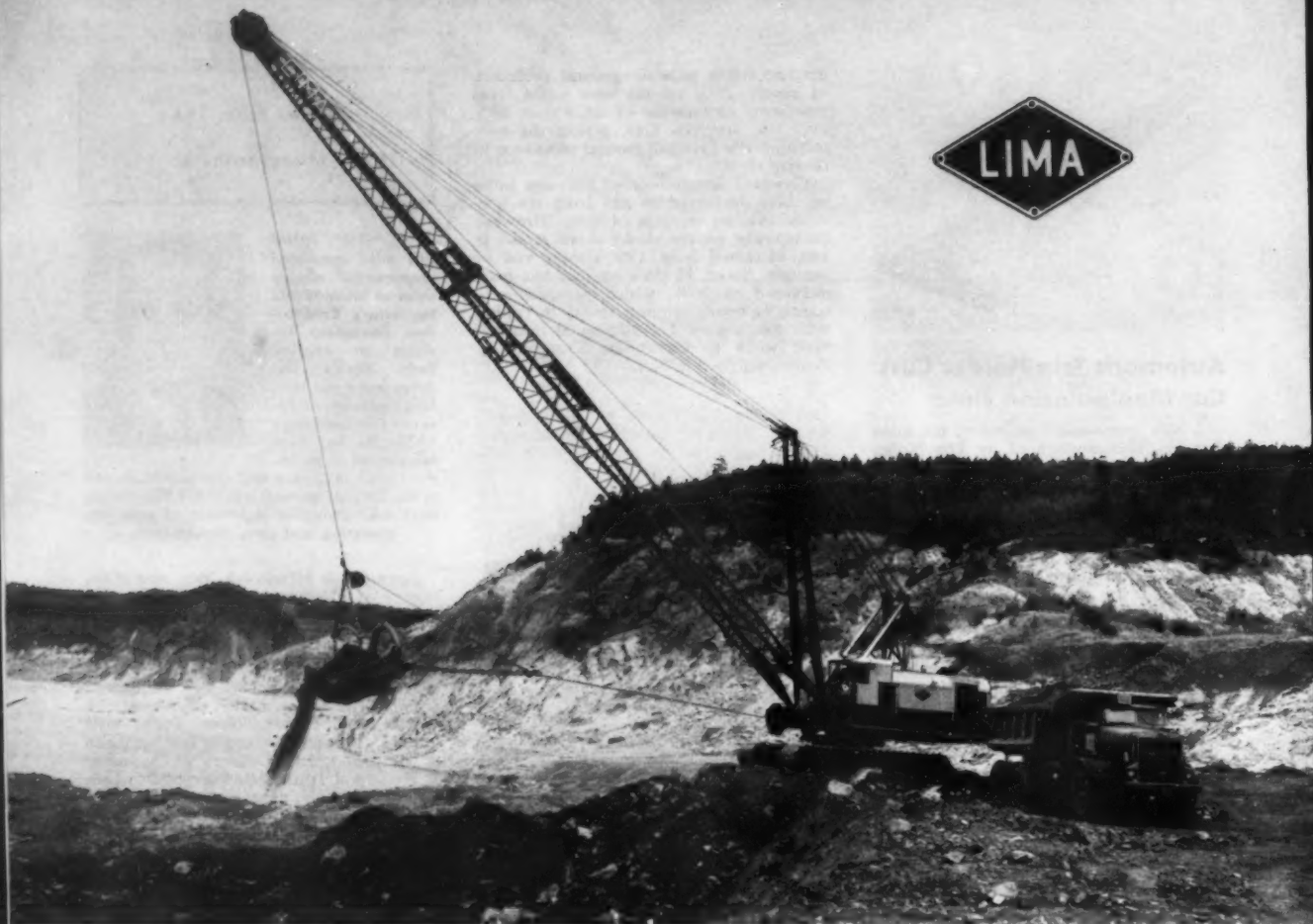
Sprague & Henwood, Inc., manufacturers of diamond drills and bits, and drilling contractors of Scranton, Pennsylvania, recently announced the formation of a wholly-owned subsidiary, Sprague & Henwood International Corporation. This new company, which will have main offices at 11 West 42nd Street, New York, will handle all export business for Sprague & Henwood, Inc. Officers of Sprague & Henwood International Corporation are: A. E. Ross, president; H. J. Longmore, executive vice president; Paul Mertzweiler, vice president and treasurer; and E. H. Norton, Jr., secretary. Mr. Mertzweiler will manage the New York office.

Gordon I. Gould & Company of San Francisco, California, designers and builders of the Gould rotary furnace and condensing system for treatment of mercury ores, announce the recent appointment of SAIMA, Speciali Apparecchiature, Industriali Meccaniche ed Affini, dell'Ing. Mario Guisti; Via Politecnico 3, Milan, Italy, as agents for this type of equipment in Italy.

Floyd R. Anderson, former administrative assistant of the Denver Division of Gardner-Denver Company, was named chief metallurgist of the firm. He will supervise metallurgical operations of all divisions of Gardner-Denver, both domestic and foreign.



Shown above is the new international headquarters of Darr-Oliver Incorporated on Havemeyer Lane in Stamford, Connecticut. The new building, occupied by the company in June of last year, provides 120,000 square feet of office space for approximately 500 executive, administrative and financial staff, Sales Department and a majority of the company's technical divisions. Located on a 20-acre tract, the building is a two-story hollow square surrounding a central court.



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The Lima Type 2400 is muscled for the really big mining jobs—as a variable capacity dragline, 6-cu. yd. shovel, or 110-ton crane. It is mounted on wide and long crawlers for extra ground contact and easy handling. Large-diameter drums are extra wide for increased cable capacity.

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operated clutches give instant response to controls. Torque converter increases output, reduces shock loading, prevents engine stall, gives cables longer life, and lowers maintenance.

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These are only a few of the many quality features that pay off for you with a Lima. As hundreds of mining operators have found, Lima's extra engineering features and built-in quality mean greater tonnage and higher profit.

There is a Lima type and size for every mining operation! Shovels $\frac{1}{2}$ to 6 cu. yds., variable capacity draglines, cranes to 110 tons. Get full information today from your nearest Lima distributor on powered-for-profit Limas—or write to us.



Lima shovel team speeds Mesabi Range ore loading—Type 604, left, $1\frac{1}{2}$ cu. yd., and Type 1201, 3 cu. yd.

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AEC Allots Quinta U₃O₈ Ore Sales Through 1956

The Quinta Corporation, operating in the Church Rock area about 20 miles west of the Ambrosia Lake uranium district of New Mexico, has received an allocation from the Atomic Energy Commission authorizing delivery of 141,000 tons of uranium ore annually from its properties. Quinta has a joint drilling contract with Phillips Petroleum Company.

From the Quinta-Phillips operation there will be a daily delivery of 450 tons of ore six days a week to mills in the Ambrosia area. This allocation runs through 1966. Mills in the area have a daily custom milling capacity of 1,100 tons.

Humboldt Will Double Jaspelite Pellet Output

Humboldt Mining Company will double its production capacity through the addition of another flotation section, as well as increased crushing, grinding, and filtering facilities at its plant located 26 miles west of Marquette, Michigan. The expansion program will increase output to 640,000 tons of Jaspelite pellets annually.

Humboldt, jointly owned by Cleveland-Cliffs Iron Company and the Ford Motor Company, has awarded an engineering-construction contract to Western Knapp Engineering Company of San Francisco. Construction has already started and commercial production is scheduled for mid-1960.

Bunker Hill Acquires Montana Phosphate Lease

The 1,200-acre Jack Pine phosphate property near Elliston, Idaho, just west of the Continental Divide, has been acquired by the Bunker Hill Company of Kellogg, Idaho, producer of lead, silver, zinc, and other metals. The property was obtained under purchase option from Russell Luke of Butte, Montana.

Although there has been no production from the property, phosphate rock crops out over a three mile strike length in a bed five feet thick. It was acquired in connection with a \$10,000,000 plant which the company proposes to build to make phosphate type fertilizers, utilizing sulfuric acid manufactured at its Kellogg electrolytic zinc plant. Sites at Kellogg and at Kennewick, Washington are being considered.

Union Carbide Awards Manganese Mill Contract

An ore dressing plant will be built for Union Carbide Ore Company, a division of Union Carbide Corporation, at Newport News, Virginia. Tidewater Construction Corporation of Norfolk has the contract. Completion is scheduled for May 1, 1960.

The new plant will process manganese ore from affiliated mining operations of Northwest Guiana Mining Company in British Guiana. About 30,000 tons of ore per month will be graded and classified. Most of the processed ore will be shipped from Newport News by rail to plants of Union Carbide Metals Company, another

division of the firm, for use in the production of alloys for the nation's steel mills.



Yreka United, Inc. has signed a working agreement which opens the way for deep development of a large area lying north of an 18,000-foot crosscut being driven by the Bunker Hill Company from its Crescent mine on Big Creek, Shoshone County, Idaho, to the Bunker Hill mine at Kellogg. The properties which Bunker Hill now has the right to probe from the crosscut include the Altura, Hill, Mohawk, Paramount, and Yreka, merged into Yreka United in 1957, and some other ground subsequently acquired. C. Whelan of Kellogg is secretary of Yreka United.

Clayton Silver Mines resumed production at its Custer County, Idaho property following a four-month suspension because of unfavorable markets for lead and zinc. The mine and mill are being operated on a five-day week, however, instead of six-day and seven-day weeks as formerly. Twenty laid-off employees were called back to work. A six-man development crew has completed deepening the mine shaft to below the 800-foot level.

Silver-copper ore has been opened on six levels of the Crescent mine on Big Creek in Shoshone County, Idaho, since the Bunker Hill Company undertook in 1952 to deepen the old Crescent shaft and seek ore bodies. More than 18,000 feet of tunneling, 800 feet of raising, and 20,000 feet of diamond drilling have been done since the 2,000-foot shaft extension was completed in 1953.

The new Conjecture mine shaft in the Lakeview mining district of Bonner County, Idaho, was nearing the 300-foot point, at last report. Federal Uranium Corporation of Salt Lake City, Utah is sinking the three-compartment vertical shaft 1,000 feet under a profit-sharing agreement with Conjecture Mines, Inc., of Spokane, Washington. R. W. Neyman is president of Federal.

Polaris Mining Company, a major producer in the Coeur d'Alene mining region of Shoshone County, Idaho for 20 years, has been absorbed in a merger with its Hecla Mining Company. Polaris stockholders receive one share of Hecla for each six shares of Polaris held. Fractional shares of Hecla to which Polaris stockholders may be entitled are being purchased by Hecla at the rate of \$10.26 each, the market price of Hecla shares at the merger date. Polaris had earned a net taxable income of more than \$13,500,000 and paid more than \$7,000,000 in dividends. Besides the Polaris vein system, being mined now from deep workings of



Eagle-Picher's \$2,500,000 Plant in Production

This is the new \$2,500,000 diatomaceous earth plant which Eagle-Picher Company placed in operation late last fall on its 63-acre site near Lovelock, Nevada. Designed and constructed by Kaiser Engineers, it is Eagle-Picher's second such plant; the other is at Clark, Nevada. The new facilities include an L-shaped, steel frame "open air" structure, 80 feet high and 63 by 51 feet in plan, supporting the drying and classifying equipment. The 9- by 120-foot rotary kiln is one of the largest of its kind in the industry. The deposit which supplies this plant is located about 15 air miles northwest of Lovelock, and is known as the Tunnel Hill deposit. It is at an elevation of about 5,000 feet. Kaiser Engineers, in checking the discovery for Eagle-Picher, delineated one area of the deposit by making about 60 bulldozer cuts and topographic mapping of a 70-acre area. Shafts were drilled 36 inches in diameter on 100-foot centers to depths of more than 100 feet. These holes were sampled and logged, the geology mapped, and calculations made to determine reserves and waste volumes. Shaft samples were then processed in a pilot plant before a design contract was awarded. The new facilities can produce 36,000 tons of natural and calcined diatomaceous earth products annually.



Digging iron ore on the Mesabi Range near Aurora, Minnesota.

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Sunshine Mining Company, Polaris holdings taken over by Hecla include the Silver Summit mine and more than two miles of Silver Belt ground to the east held under operating agreements. The Polaris-Silver Summit ore body is nearly mined out and operations may soon be limited to exploration for new ore reserves. Stopping of the small block of ore in the Rainbow Area continues. Production from the Unitized Area, operated by the Sunshine mine, continues at a somewhat increased rate over last year.

ICM Finance Corporation has gone into receivership to protect interests of shareholders and creditors following withdrawal of Hecla Mining Company, Wallace, from an agreement to develop the Livingston lead-zinc mine of Idaho-Custer Silver-Lead Mines in Custer County, Idaho. H. F. Magnuson of Wallace, company secretary, is receiver.

The primitive Stanley area in Custer County appears to be developing into Idaho's only commercial uranium mining district. More than 250 claims have been staked in a 36-square mile area. Western Fluorite Corporation shipped 22 carloads of ore during the past season, and Phillips Petroleum Company, 15 carloads. Rare Metals Corporation of America, a subsidiary of El Paso Natural Gas Company and Sidney Mining Company of Kellogg, Idaho, have uncovered promising ore showings.

Calera Mining Company of Cobalt, Idaho has laid off 70 miners in a move toward closing underground operations at its Blackbird cobalt mine. Output of the open pit mine is to be increased because mining costs are lower than for the underground operation. The pending shutdown of the government's domestic cobalt purchasing program in mid-1959 has been a major factor in the decision to change. Total underground and open pit output had been between 1,000 and 1,300 tons daily.

Central Farmers Fertilizer Company, and National Potash Company have signed an agreement which provides for Central Farmers to acquire a stock interest in National Potash. National Potash will undertake production of potash materials for distribution by Central Farmers. Central Farmers expects to start production of phosphate rock and triple superphosphate from its new mine and plant at Georgetown, Idaho in April. National started operations in 1957 near Carlsbad, New Mexico.

Bunker Hill Company has organized a new industrial engineering department at its offices in Kellogg, Idaho, under the supervision of W. A. Boyer. The department will make studies in the field of modernization and improvement of plants and methods. First assignment will be to study and collect data relative to utilization of manpower and facilities. Included will be such items as new equipment evaluation and justification, scheduling of critical production activities, quality control of finished products, and training in work simplification.

The Copper Queen mine in Lemhi County, Idaho has been active during the past season. A 50-ton mill for treatment of the copper-gold ore has been under construction and reportedly is almost completed.

Development of a five-foot vein of high-grade silver ore on the Garden Creek Silver Lode claim No. 3 in the Bayhorse mining district of Custer

County, Idaho is planned by the owners, Mrs. Lena E. Greig and Stanley W. Greig. G. Elmo Shoup of Salmon is manager.

MONTANA

Canadian and French industrialists have been showing interest in iron ore discovered in the Carter Creek drainage area east of Dillon, Montana where Minerals Engineering Company of Grand Junction, Colorado had been processing tungsten. Engineers have estimated reserves at 200,000,000 tons containing 30 percent or more iron. There has been speculation that the ore might be used in a steel mill which would be constructed in the Crows Nest Pass bituminous coal area of Alberta, Canada.

A 2,600-foot tunnel is being driven to connect the Cape Nome and Hidden Treasure mines near Clinton in Missoula County, Montana. The work is being done by Hera Exploration Company of Renton, Washington, which has unwatered and renovated the old Cape Nome 500-foot shaft. Lower levels, under water since 1912, were found in excellent condition and several raises were found with ore ready for mining. The connection will provide drainage and ventilation for both mines. The company is milling copper-gold-silver-lead ore from the Hidden

Treasure and shipping concentrates to the Anaconda Company smelter.

St. Paul Lead Company and Merger Mines Corporation, north Idaho firms, are putting finishing touches on their new 100-ton flotation plant 10 miles south of Libby, Montana in expectation that lead-zinc prices this spring will permit start of operations. Initial treatment would be of ores from the St. Paul and Snowshoe mines, although custom shipments would be accepted. Onni Herlin of Coeur d'Alene, Idaho, is mine superintendent. A. L. Osborn, Spokane, is president of St. Paul Lead.

The Montana Land Board has authorized the subleasing of a Beaverhead County mining operation on state land to Gustave Ring of Washington, D.C. Sodak Uranium Mining Inc. is the original lease holder. One of the officials of the land office said that this sublease was authorized so that an effort could be made to obtain enough funds to operate the mine and it may develop into a large manganese open pit mine.

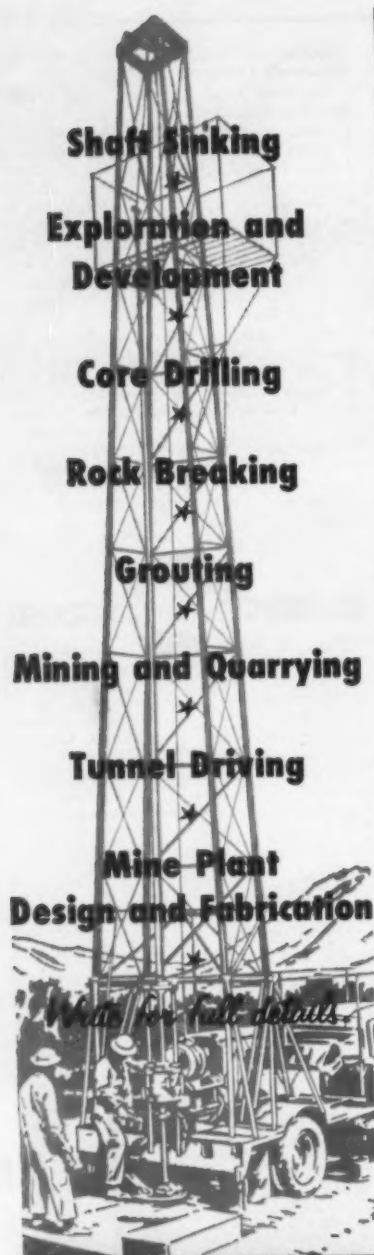
WASHINGTON

Several shipments of high-grade barite have been made from Eagle Mountain, east of Chewelah in Stevens County, Washington, by W. Randolph Green, Spokane mining engineer, and Joe Hodg-



Daybreak Finds More Ore on Washington Lease

Daybreak Uranium Inc., which has already mined more than \$300,000 worth of autunite from its Dahl open-pit mine in the Mt. Spokane district of Washington, still has undeveloped prospects. A new underground mining operation is underway on the same property. Daybreak first started this underground work last year, using tractors and loaders, but ran into problems of roof support and ventilation. Then the firm switched to mine cars hoisted by winch and cable to remove the waste and ore from a 5- by 7-foot development incline started off the open pit and this has been quite successful. The inclined shaft follows a mineralized shear zone. The picture above shows the incline portal where material is dumped into trucks which move it out of the pit to waste dump or ore pile. The two men are Kae Sowers and F. E. Birch. This work is being done under a profit-sharing agreement with Addy Development Company. Daybreak has also been downhole drilling on an adjoining tract and has found another autunite deposit beneath 15 feet of overburden.



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CENTRAL AND EASTERN

son, Spokane, in charge of mining operations. The ore was mined by open-pit methods and shipped to Colorado. Four men were employed.

The South Penn mine in the Republic mining district of Ferry County, Washington has been taken over under a lease and purchase contract by **Thomas Consolidated Mines, Inc.** of Spokane. Discovered in the late 1930s, the mine has yielded 45,000 tons of gold-silver ore, most of which went to the Trail and Tacoma smelters. All production has been from open-pit work. The values occur in a disseminated zone which has been mined over a width of about 75 feet and length of more than 300 feet. Shallow drill holes have indicated that the ore continues downward. This is the second property in the district obtained by Thomas Consolidated in the past year. At the Valley mine, it has repaired the shaft collar and renovated camp buildings. David E. Watson of Spokane is company president.

Skookum Uranium, Inc. plans to make an initial shipment of uranium ore from its Pend Oreille County, Washington property as soon as weather permits. A heavy snowfall in November balked efforts of the firm to make a shipment of autunite before winter. About 15 tons of high-grade and 100 tons of low-grade had been stockpiled from bulldozer operations. The vein is in a shear zone in decomposed granite in an area of radioactive springs near Skookum lake. Theodore A. Tester of Opportunity is president, and George R. Cole is secretary.

Removing granite boulders cemented in ore-bearing conglomerate has resulted in making an acceptable grade out of some low-grade at the former **Northwest Uranium** property in the Spokane Indian Reservation, Stevens County, Washington. **Silver Buckle Mining Company**, the owner and operator, has shipped and stockpiled sufficient uranium ore to assure recovery of stripping costs. The **Washington State College Mining Experiment Station** is working on a simple, mechanical upgrading process which can break up the conglomerate without crushing the boulders.

Kromona Consolidated Mines Inc. of Seattle, Washington has acquired all of the assets of the **Victory Mines Corporation** including the **Kromona** mine at Sultan. The company has carried on an extensive development program at the mine during the past season, and shipped concentrate from the development ore to the Tacoma smelter. The development program disclosed some molybdenum in the ore, and further investigations are being made to determine the amount of molybdenum present in the ore body. If it proves to be of commercial value, equipment may be installed in the mill to provide a separation from the copper concentrate. Joe F. Krom is president, and H. P. Nielsen is vice president.

miners in the area and milled for shipment to **Granite City Steel Company** plants at Granite City, Illinois.

Surplus industrial buildings and equipment of the former **Cuban American Nickel Company** nickel and cobalt pilot plant about 15 miles southeast of New Orleans, Louisiana have been offered for sale by the **General Services Administration**. Machinery and equipment include such items as tanks, belt conveyors, ball mill, hydrogen generator equipment, and other equipment used in various ore treatment processes which could be used elsewhere for many similar purposes.

Omar Austin is making shipments of acid-grade fluorspar concentrate from the flotation mill in Rosiclare, Illinois which he leases from **Rosiclare Lead and Fluorspar Mining Company**. The mill had been closed since 1954 until Mr. Austin recently took it over, repaired, and restored it to operating condition.

International Minerals & Chemical Corporation has brought its phosphate chemicals and phosphate minerals divisions into a single phosphate unit, and consolidated research and engineering into one staff division handling research, engineering, and development. George W. Moyers heads the new division, and Dr. I. Milton Le Baron directs the newly created staff unit.

About 4,000 pounds of boron are being used as an alloy in the 500-ton steel shielding floor of the atomic reactor in the Enrico Fermi power plant near Monroe, Michigan. The alloying represents a one percent addition, which is rare in the metal working industry; normally boron is added to a steel melt as a hardening alloy, and in minute quantities. In this case, it is being used to help shield the operating floor from gamma rays emitted by the fast breeder reactor.

The rare earth metals, praseodymium, terbium, holmium, thulium, ytterbium, and lutetium, can now be obtained from inventory in commercial quantities from **Michigan Chemical Corporation** in St. Louis, Michigan. The firm has been carrying inventories of gadolinium, dysprosium, erbium, and yttrium for about a year. Other rare earth metals, such as europium and samarium, will be available on a custom basis. This is the first time that most of these rare earth metals have been available in quantity from any commercial source.



New Jersey Zinc Company has opened its **Treadway** zinc mine in Hancock County, Tennessee after a one-year delay. The low price of zinc kept the mine out of production although the mine had been developed and all surface installations completed.

The **W. S. Moore Company**, large iron ore operator on Minnesota's Mesabi Range, is said to be seriously considering developing high-grade iron ore deposits in upstate New York near Saranac Lake. The firm has been investigating deposits in the area since late 1956, and is reported to be particularly interested in a site just west of Meacham Lake. One



The **E. C. Schroeder Company** of McGregor, Iowa is reported to be planning erection of a heavy media iron ore processing plant near West Plains, Missouri. Iron ore would be purchased from

important deterrent is in inadequate transportation.

Anaconda Aluminum Company has moved its executive offices to Louisville, Kentucky. New president will be Archie P. Cochran of Louisville, former president of Cochran Foil Corporation before its recent merger with Anaconda Aluminum. When alumina clay processing facilities are completed at Moscow, Idaho, Anaconda Aluminum will then be fully integrated from mine to metal products.

E. I. du Pont de Nemours & Company has placed its Trail Ridge and Highland ilmenite plants in Florida on a full seven-day work week after a year of cut-back operation. At the same time, the company's plants at Baltimore, Maryland and Edgemoor, Delaware have also resumed full production. The latter plants process the ilmenite into titanium dioxide. A stronger market for titanium dioxide was responsible for management's decision to resume full operation.

A new course in magnetic and gravitational prospecting will be added to the curriculum in mining engineering at Lehigh University in Bethlehem, Pennsylvania. The course will be devoted to a study of magnetic properties of rocks and minerals; it includes a study of the theory and description of magnetic instruments, a treatment of gravitational instruments, corrections, interpretations, and results.

The feldspar mines and associated buildings in Spruce Pine, North Carolina are being offered for sale by the Whitehall Company, Inc., through a local representative, A. C. Tainter. Whitehall, manufacturer of "Bon Ami," stopped shipments of feldspar from these properties about 10 years ago.

Pittsburgh-Pacific Company of Hibbing, Minnesota, owner of the Ringwood Mines at Ringwood, New Jersey, is asking for a reduction in taxes. The company seeks a cut of \$83,025. The present assessment is for \$81,525 on the land and \$145,250 on the buildings; the company wants these reduced to \$80,000 on the land and \$83,750 on the buildings. The Borough Council will contest the appeal.

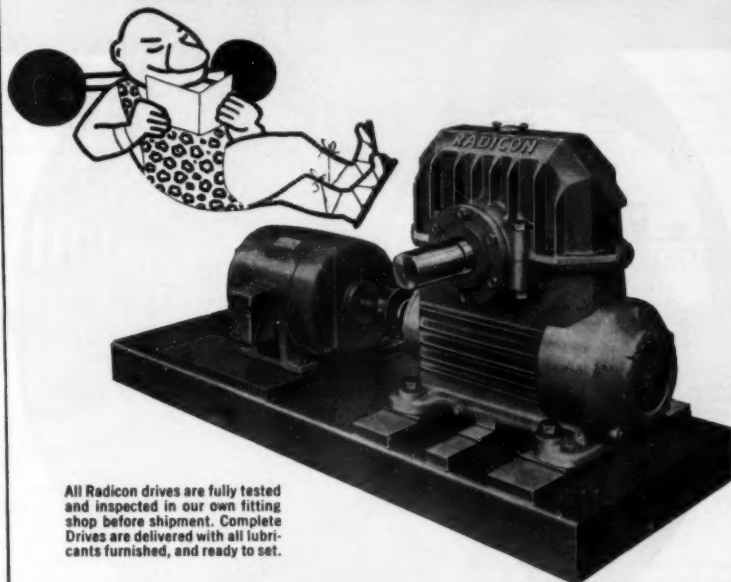
Aluminum Company of America is broadening the scope of its research and development program by revamping and extending its internal network of technical advisory committees, and placing them under more complete direction by the overall research and development committee. The membership of the latter will be increased from 13 to 23 persons. A new campus-type research center will be constructed at Merwin, Pennsylvania.

Improvements and modifications are being made at the Bonnie chemical plant of International Minerals & Chemical Corporation at Bartow, Florida. Completion is scheduled for this summer. An employee change house, replacing a small and inadequate one, is the main new building in the program. The other is a new bag storage plant. Additional equipment for manufacturing of fluosilicic acid is the main production item. Improvements include better ventilation and dust control equipment; improvement of the plant's system for handling liquid waste disposal; installation of new electrical transformers; and additional maintenance shop equipment.

A group of Tennesseans are reported to have formed a new chemical concern, Oolite Minerals Corporation, to process calcium deposits for manufacturing uses. The company has acquired mineral rights

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CENTRAL AND EASTERN

on large oolite deposits in Stewart and Franklin counties, and will begin mining and processing at either Anderson or Dover. John W. Gonce is president; W. A. Jones, vice president; Gerald S. Hunter, treasurer; Mrs. Sue S. Kolbe, secretary.

Maine Metal Mines and Prospects is the title of a new publication of the **Maine Geological Survey**. The booklet contains information on more than 350 reported occurrences in Maine of such metals as manganese, iron, tungsten, copper, lead, zinc, nickel, silver, and gold. More than 200 such occurrences are shown accurately on detailed maps, some of which also show the local bedrock geology. Copies may be ordered at 85¢ each from John R. Rand, state geologist, Department of Economic Development, Augusta, Maine.

Three total-intensity aeromagnetic maps of an area in western New Hampshire and eastern Vermont have been released by the **Department of the Interior**. The maps were prepared in cooperation with the **New Hampshire State Planning and Development Commission**. They show by contours the magnetic pattern of the areas flown, and provide basic geophysical information useful in aerial geologic mapping and mineral resources investigation. The Canadian government made similar investigations several years ago and announced that ten companies went in and checked property on the basis of the maps and found ore. The maps, "Aeromagnetic map of Littleton and vicinity, New Hampshire and Vermont," "Aeromagnetic map of Woodsville and vicinity, New Hampshire and Vermont," and "Aeromagnetic map of Lake Tarleton and vicinity, New Hampshire and Vermont" are numbered GP-194, GP-195, and GP-196 respectively in the **Geophysical Investigations Map Series**. They can be purchased for \$0.50 each from the **Distribution Section, United States Geological Survey**, Washington 25, D. C.



Total Lake Superior District shipments during 1958 amounted to 52,868,028 gross tons of iron ore compared to 54,615,871 gross tons for 1957. This 1958 figure is the result of slower steel activity during the year and is reflected in the extremely slow start of many upper lake ore docks in the spring. Only two ports showed shipping increases over 1957, namely, the **Duluth South Shore and Atlantic Railway** are dock at Marquette, Michigan, and the **Algoma Central Railway** dock at Michicopoten, Ontario. The **Duluth, Missabe and Iron Range** ore docks at Two Harbors and Duluth showed the largest decrease, 16,200,000 tons. The **Great Northern Railway** docks at Superior showed a decrease of 11,700,000 tons compared to 1957 shipments.

The name of **Hanna Coal & Ore Corporation** has been officially changed to **The Hanna Mining Company**. Stockholders in **M. A. Hanna Company** and **Hanna Mining Company** have been offered the right to subscribe for common stock of the **Hanna Mining Company**. With the sale of these shares, the company has ceased

to be a majority owned subsidiary of M. A. Hanna, say company officials, although the latter will continue to be a large minority stockholder. The mines in the Minnesota district affected by the change of name include the **West Cuyuna Group, Spring Valley and Perry and Carlz**. In Michigan, the **Wauseca and Groveland** mines and the mine in Riddle, Oregon are Hanna Mining Company properties.

Estimated tonnages for 1959 indicate optimism when compared with 1958, as some companies forecast increases up to 40 percent for the coming season over the 1958 shipments. Recent announcements by **Pickands Mather & Co.** indicate reactivation of the **Bennett** mine at Keewatin, Minnesota following a year of inactivity. **Oliver Iron Mining Division of U.S. Steel Corporation** has placed its **Hibbing-Chisholm** district employees on a five-day week for the first time since 1957.

Jones & Laughlin Steel Corporation is rehabilitating its **Cleveland Works** ore dock on the **Cuyahoga River** at a cost of \$533,000. The program is to be completed by the summer of this year. It will provide modern facilities for unloading limestone which is shipped to **Cleveland** from Michigan. A similar program was undertaken in 1950 for improvements in iron ore unloading facilities.

COLORADO

As a result of increasing lead and zinc prices, **Emperius Mining Company** at **Creede, Colorado** has been able to resume operations. Until its forced closing last year because of depressed prices, the company had been a steady producer for the past 25 years.

The **U.S. Bureau of Mines** has plans for releasing oil shale by means of an atomic explosion. The site tentatively selected for this atomic blast is in the **Piceance Creek basin** in northwest Colorado where extensive core sampling has indicated a trillion barrels of oil in the shale. No date has been set; much depends upon industry cooperation.

Despite last year's adverse mining conditions, the **Eagle mine** of **New Jersey Zinc Company** at **Gilman, Colorado** maintained full rate of production on a three-shift basis. Average output was about 4,500 tons of zinc concentrate and 600 tons of lead concentrate per month. Copper-silver ore shipments averaged about 3,000 tons monthly. Exploration and development work were curtailed and only essential repair and maintenance work was carried on.

Clyde Long has made the first shipments of high-grade uranium ore ever made from **San Juan County, Colorado**. The pitchblende and uraninite ore comes from the **Long mine** at **Elk Park**, near **Silverton**, where Mr. Long and his crew are presently crosscutting on a series of veins. The **Gunnison Mining Company's** mill at **Gunnison** is receiving the ore for treatment.

Rico Argentine Mining Company has declared a dividend despite the fact that its lead-silver-zinc mine in the **Rico dis-**

trict of **Colorado** has been closed down for more than a year because of low metal prices. The firm's principal operation now is production of sulphuric acid from pyrite produced in another section of the property.

Beaver Mesa Uranium Inc. of **Grand Junction, Colorado** has been steadily developing since its formation in 1955. From a monthly output of about 1,500 tons of ore mined, the present rate has grown to 6,000 tons monthly. The firm has under lease about 2,000 acres with important potential uranium ore reserves. Ore is shipped to the **Urvan and Rifle mills** of **Union Carbide Nuclear Company**.

The **Beryllium Mining Association** of **Fort Collins, Colorado** has changed its name to **North American Beryllium Mining Association**. The group recently elected **John M. Phillips**, president of the **Colorado Beryllium Corporation**, as the new president of the Association.

UTAH

Stoping of a 31,000-ton body of 0.40 percent uranium oxide from the **Hot Rock** property in the **Big Indian District, San Juan County, Utah**, has been started by the operating firm, **Hecla Mining Company** of **Wallace, Idaho**. The ore body was reached by a 2,000-foot crosscut from the **Radon** mine, also operated by **Hecla** for **Radorock Resources, Inc.**, subsidiary of **Federal Uranium Corporation** of **Salt Lake City**. **R. W. Neyman** is president of **Federal**.

Superior Oil Company of **California** is reported to have discovered potash in the southwest portion of the **Lisbon Fault** in **San Juan County, Utah** where the firm controls an estimated 10,000 acres. Details have not been released but there are indications that the mineralization was found at about 2,400 feet and 3,600 feet in drill cores.

The **American Gilsomite Company** has leased the facilities formerly used by **Howe Sound Company** in **Salt Lake City, Utah** and will move soon.

In an optimistic vein, **R. G. Sullivan**, president of **Minerals Engineering Company** in **Grand Junction, Colorado**, comments that the company may resume mining, milling, and refining of tungsten in the second half of 1959, if the present rate of tungsten consumption continues. The company is part owner of the **Salt Lake Tungsten Company's** refinery in **Salt Lake City, Utah**, and owns and operates mines and a flotation mill in **Montana**.

Headquarters of the strategic minerals section of **Phillips Petroleum Company's** exploration division have been moved from **Salt Lake City, Utah** to the company's central land and geological office in **Bartlesville, Oklahoma**. **C. N. Holmes**, director of the strategic minerals section, and **D. E. Fryhofer**, land assistant to the director, are being transferred from **Salt Lake** to **Bartlesville**.

Kennecott Copper Corporation's Utah Copper Division is experimenting with a new method for building dikes. Now in the test stage, the division is using its own tailings from its copper concentrators to build the 60-foot-wide dikes around the 5,800-acre tailings pond serving the **Arthur and Magna** mills. A 1,500-foot-long pipe is carrying the tailings to the inside edge of the present dike. Currently, about 7 percent of the entire tailings discharge is being moved this way. If the experiment works, it will save the division about \$180,000 annually. The present method for building dikes is to haul and dump gravel fill material.

The **Fourth Annual Uranium Symposium** will be held by the **Uranium Section** of the **AIME** in **Moab, Utah** on **May 8, 9, and 10**. The meeting will be open to the public and will feature technical papers on all phases of the uranium industry.

A high-grade fluorspar mine east of **Ogden, Utah** is reported to be shipping ore to the **Clearfield Naval Supply Depot** on a government contract. The mine was discovered by **Dale Norman** of **Ogden** in 1952.



Kennecott Takes Over Garfield Smelter

Utah Copper Division of **Kennecott Copper Corporation** is now a completely integrated operation, from raw material to refined copper shapes, with the transfer of **American Smelting and Refining Company's** **Garfield smelter** to **Kennecott** control. Built in 1906 by **Asarco**, the smelter was purchased by **Kennecott** in 1958, but ownership did not actually change hands until **January 1, 1959**. Reputed to be the world's largest copper smelter, it has a total rated capacity of more than 1,000,000 tons of concentrate annually, and a maximum potential output of about 325,000 tons of blister copper per year. As a byproduct of smelter gases, more than 1,000 tons of sulfuric acid are produced daily. **Kennecott** assumes complete ownership and control of the smelter except for the five acid plants operated by **Garfield Chemical & Manufacturing Corporation**. There will be no change in ownership of **Garfield Chemical**; **Asarco** and **Kennecott** each retain 50 percent of the capital stock.

The government uranium mill at Monticello, Utah will close this year, according to reports from the area. Ore purchases are said to have stopped already, and the stockpiles are being milled. No official announcement has been made, however **National Lead Company** operates the plant for the AEC.

United Mercury & Oil Corporation, with headquarters in Glendale, California, is producing sulphur from a mine near Milford, Utah. They have recently discovered cinnabar along the footwall of the mine. Grover Kihorny is manager.

WYOMING

Columbia-Geneva Steel Division of **U.S. Steel Corporation** continues to consolidate its position in the Atlantic City, Wyoming area where it is considering development of a large, low-grade iron ore prospect and construction of an iron ore upgrading plant. The firm obtained assignment of a lease on 161 acres of state-owned land in the area, and consent of the state to put it up for sale. In open bidding in Lander, U.S. Steel acquired the property. The company plans to use it for a tailing dam and for part of a railroad right-of-way to Winton, Wyoming. Columbia-Geneva has also obtained water rights from the **Timba-bah Mining Company** for about \$22,500. The transaction reportedly includes 2.5 cubic feet

first and primary rights to the flow in Rock Creek. The steel company also has two more options for similar rights from Timba-bah.

Western Nuclear Corporation's mill at Jeffrey City, Wyoming received the first shipment of sulfuric acid from the new plant of **Fremont Minerals Inc.** at Riverton. The plant is the first in the state to supply acid to the uranium industry. It was built under contract by **Leonard Construction Company** of Chicago at a cost of \$750,000.

ARIZONA

Magma Copper Company has renegotiated terms of the indebtedness of its subsidiary firm, **San Manuel Copper Corporation**, with the **U.S. Treasury Department**. San Manuel had been authorized to borrow \$94,000,000 to develop the **San Manuel** copper property in Arizona. Quarterly payments (\$1,550,000) of the principal were to start in 1959. Actually, however, San Manuel only borrowed \$76,771,000, so the quarterly payments now will be only \$1,250,000, or a total of \$5,000,000 during 1959.

W. A. Hayes of Oakland, California has taken over the **Swastika** silver-copper mine in Yavapai County, Arizona and preparations are being made for its reopening. A 300-foot crosscut will be

driven to the copper vein exposed west of the silver vein. When completed this will give four levels from the main workings. The 400-foot shaft located on the Prince silver vein will be dewatered and deepened to the 500 level in order to explore that area. Operations are under the supervision of **Bill White** of Congress Junction, Arizona.

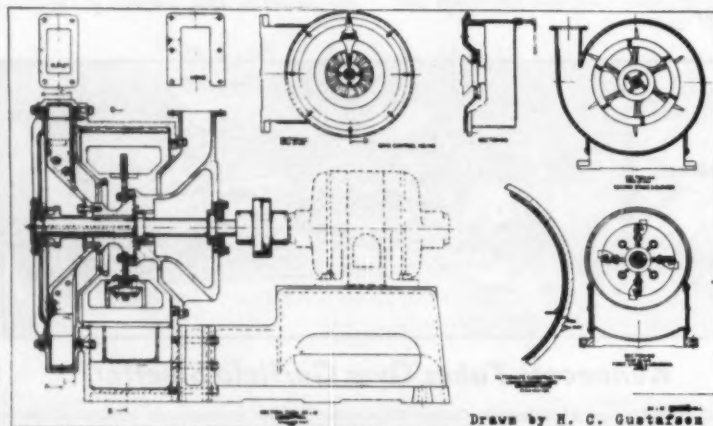
Plans for a \$500,000 manganese operation in the Willow Creek area about 50 miles south of Winslow, Arizona have been announced by **B. J. Brummell** of Coronet, Kansas. He is associated in the venture with **William Humphrey** and **Frank Zook**.

The **Bald Eagle Mining Company** is making steady progress in its development of eight gold claims in the San Francisco mining district of Mojave County, Arizona. A 100-foot shaft has been timbered down to water, 60 feet below the surface, and some new drifting has been done. Equipment has been installed, including a portable compressor, water pumps, 25-hp engine for hoisting, and other machinery. **Quincy Crain** is president of the firm.

The **U.S. Bureau of Reclamation** has filed application for withdrawal of 10,000 acres for mineral entry in the proposed **Marble Canyon Reservoir** area on the Colorado River, about 30 miles downstream from **Glen Canyon Dam**. The area is a proposed site for future dam construction.

The **College of Mines** of the **University of Arizona** will hold a symposium and educational program on the appli-

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cation of the Fluidizing Reactor to the Mineral Industry. The educational program will be held February 23 through 27; the symposium will be held on March 2, and a field trip to the new **Kennecott** smelter at Hayden is planned for March 3. Individuals attending the educational program should bring slide rule and "Handbook of Physics and Chemistry."

Approximately 1,065 acres of public lands near Wickenburg, Arizona were opened to mineral location in late December. The opening was handled by the U.S. Bureau of Land Management.

American Cement Corporation, which is building a \$16,000,000 cement plant in Clarksdale, Arizona to furnish cement for the Glen Canyon Dam project, has formed a new division to be known as **Phoenix Cement Company**. It will produce and market cement from the new Clarksdale plant. Ray R. Adams is president of the new subsidiary, and Frank N. Steadman is vice president.

Occasional shipments of high-silica copper ore are being made to the Hayden smelter from the **Gold Hill** group of claims in the Amole district, about 11 miles southwest of Tucson, Arizona. Owners and operators of the property are **Strong & Harris, Inc.** of Tucson, Arizona, with R. H. Harris in charge.



The **Sunray Mid-Continent Oil Company** has a six-man crew at work conducting core drilling operations on a 75,000-acre section of the Mojave Desert in California. The exploration crew has been making geophysical examinations and doing core drilling from a specially adapted shot hole rig for almost a year. Sunray's geologists believe that more commercial deposits of saline and other minerals are to be found in the Mojave, including such minerals as borax, trona, beryllium, kyanite, bastnaesite, and monazite.

Holding Mining & Development Company of Menlo Park, California has been developing the **Shoestring** tungsten mine at Tioga Pass in Lee Vining Canyon Mono County, for the past two years. The ore body is a massive tactite deposit in contact on the footwall with granite and on the hanging wall with limestone. Assays show molybdenum sulphide, tungsten trioxide, gold, and silver. **Utah Construction Company** has shown some interest in the property. First work considered for the spring is to churn drill below the 800-foot depth to prove continuation of the ore body on the north and south exposures.

Construction of a new road across the sand dunes east of Brawley, California provides **Vista Mining Company** with easy access to its gold placer property in the Imperial Valley. C. R. Zappone, a former government surveyor, purchased 30,000 acres of land in this area years ago, and has been developing these holdings ever since. He and his partner, Chester W. Adams, are almost ready to go into full-scale production. One of the principal remaining tasks to be completed is installation of a 3½-mile pipeline from the company's water well to the reservoir.

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and adjacent placer installation. These are to be finished by next fall.

H. M. Holloway Inc. of Wasco, California is on a double shift at its Lost Hills agricultural gypsum mines. The mines had been working a single shift with a daily output of about 3,000 tons of processed material, but there has been an accelerated demand for the product.

A comprehensive program of mine and plant improvement is under way at the property of Sonoma Quicksilver Mine Inc. in Guerneville, California. When completed, the company expects to cut its operating costs considerably. According to S. R. Smith, president, since the end of fiscal 1958 "the tonnage of positive ore developed has more than replaced ore mined during the same period."

Gold Canyon Mines Inc. of Stockton, California is undertaking construction of a mine access road to its Gold Canyon mine in the Alleghany mining district of Sierra County, California. A power line will be installed, and necessary machinery and equipment will be purchased as soon as possible. The Gold Canyon mine has been dormant for 40 years.

The Greater Los Angeles Chapter of the National Safety Council, in cooperation with 36 co-sponsoring organizations,

has completed plans for the Sixth Annual Western Safety Congress and Exhibits. The Congress will meet at the Ambassador Hotel in Los Angeles March 23 through 25th. Contact Mr. Joseph M. Kaplan at the Council headquarters, 3388 W. 8th Street, for further information.



The second largest single Nevada iron ore shipment ever made through the Port of Stockton, California was handled in December when 16,902 tons of ore were loaded aboard the M.S. "Hokyo Maru" owned by Nippon Steamship Company. The vessel is the largest ore carrier to ever visit the port. The same vessel set the port's all-time ore shipping record in September 1958 when it took on 17,016 tons of iron ore. The ore comes from Nevada mines.

An extensive iron ore deposit estimated at 60,000,000 tons reportedly has been discovered by geologists of the Southern Pacific Land Company. The discovery was made in Buena Vista Valley, about

25 miles east of Lovelock, Nevada, and officials say that a 50-square-mile area is now being investigated. Some 26,000 feet of drill holes indicated the extent of the deposit. The company's original drilling program was planned for about 40,000 feet at a cost of about \$250,000.

Spardome Mining Company is drilling on its fluorite property in the Gabbs area of Nye County, Nevada. The work is actually being done by Boyles Brothers Drilling Company under contract. So far good widths of fluorite ore have been found on the 175-foot level of the mine.

A silica deposit at Cuprite, Nevada reportedly is under development by Western Silica Company of Bakersfield, California. They are said to have acquired the property from Margie Guyott and Bill Peterson.



Anaconda Company has discovered another uranium ore body several miles west of its Jackpile mine in Valencia County, New Mexico. Estimates are that



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the ore body contains 7,000,000 to 8,000,000 tons but it has not been fully explored and it may be several years before the whole ore body is outlined by drilling.

International Minerals & Chemical Company has made several recent improvements which add to the efficiency of operations at Carlsbad, New Mexico. An automatic loading station has been installed on the sylvite level of the mine to load discharge from a conveyor belt into mine cars with a minimum of operating labor. Three new loading machines are planned which will be built lower and heavier, especially designed for high loading capacity in low height stopes. This will make it possible to be more selective in mining only the higher grade ore in areas where the ore bed is thinner. The machines also will reduce time and material costs in maintenance work.

The Black Jack Corporation's properties have been acquired by Sabre-Pinon Corporation. Principal assets are 97 mineral leases covering 15,436 acres of Indian land in the Ambrosia Lake area of New Mexico. These leases are said to be the largest remaining block of unexplored property in the Ambrosia Lake uranium district.

The United States Potash Company, division of U.S. Borax & Chemical Corporation, at Carlsbad, New Mexico has found a new use for roof bolt drills. A new Joy RBD8 roof bolt drill has been placed in service in the final mining area drilling 40-foot holes into the back at all pillar intersections to relieve pressure on the back caused by air pockets in the formations above the ore body. Company officials believe this will lessen the danger of backfalls in the mining area.

Potash producers in the Carlsbad area of New Mexico report that they are unable to obtain adequate insurance because of proposed AEC underground nuclear explosions in the salt beds about 25 miles southeast of Carlsbad. "Project Gnome" as it is called, is scheduled for August. The AEC has been asked to obtain the insurance for the potash firms.



Initial operations at the newest and largest alumina refining plant of Aluminum Company of America have started. Though the new Point Comfort, Texas plant is still incomplete and will remain so during most of 1959, sufficient equipment has been installed to begin shake-down operations. When in full operation, the plant will have an annual capacity of 1,000,000 tons. The plant will process bauxite ore from Surinam and the Dominican Republic.

Texas Gulf Sulphur Company is continuing its search for sulphur deposits, but is also seeking pyrite and other metallic sulphides, including copper, lead, and zinc sulphides, as well as other minerals and oil and gas. The purpose of these activities, says the firm, is to explore the possibilities of diversifying operations into related industries where the company might use its extracting and processing experience.

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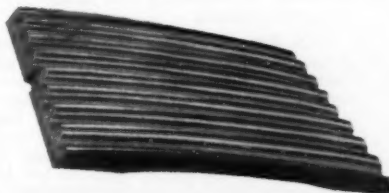
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Newsmakers in International Mining

C. E. BARTLETT has been named resident manager of Reynolds Metals Company's bauxite mine in British Guiana. Prior to his work as consulting engineer in Salt Lake City, Utah, he was resident manager of Compañia Minera de Guatemala and from 1954 to 1956 was mineral adviser to the Cuban government. From 1950 to 1954 he served as executive assistant to the general manager of Combined Metals Reduction Company of Salt Lake City, Utah.



K. M. Lee, associate professor of mineral dressing at the engineering college of Chonbuk University in Iri, Korea, has recently returned from a six-month trip to Australia.

David C. Sharpstone, consulting geologist with headquarters in Bulawayo, Southern Rhodesia, is in Toronto, Canada, at 202 Heath Street, West. Mr. Sharpstone will spend three months in Canada and the United States before returning to Southern Rhodesia.

N. A. Gilberthorpe has moved from Radium Hill, South Australia, to Storey's Creek, Tasmania.

R. W. Whitney, **Fred D. Vines**, and **Jack Buford**, all of the general office of The M. A. Hanna Company in Cleveland, Ohio, have completed a trip to the iron ore exploration operation of the Hanna interests in Brazil.

Norman K. Tschirley, assistant chief engineer of Baroid Division, National Lead Company, visited Iran late last year. He is reported to have negotiated with Iranian mining people about possible developing of barite deposits.



CLYDE E. WEED (center), chairman of the Anaconda Company, is shown with (left to right) **CHARLES M. BRINCKERHOFF**, Anaconda president; **WILBUR JURDEN**, who was named president of Anaconda-Jurden Associates, Inc., a new, wholly owned subsidiary named in Mr. Jurden's honor; **C. J. PARKINSON**, Anaconda vice-president and general counsel; and **EDWARD S. MCGLONE**, Anaconda executive vice president. This picture was taken at the meeting announcing the formation of the new Anaconda-Jurden Corporation.

G. B. O'Malley has been appointed acting managing director of American Cyanamid Company's Australian subsidiary, Cyanamid Australia Pty. Limited. Mr. O'Malley has served with Australian organization for nineteen years, after beginning as a field engineer in the Mining Chemicals Division. The medal of the Australian Institute of Mining and Metallurgy was awarded to Mr. O'Malley this year for distinguished service to his profession. He succeeds **William D. Sandel**, who returned to the United States to become manager of manufacturing for Cyanamid's Surgical Products Division.

William P. Morris has been appointed general manager of the New York and Honduras Rosario Mining Company with headquarters in Honduras.

Dutch mining engineers **M. Th. Wiessner** and **J. C. Klinkert**, both lecturers of the Mining Department, Technical Faculty of the University of Indonesia at Bandung, have returned to Holland.

Bengt Axelsson, former manager of the workshops at Luossavaara-Kiirunavaara AB, Kiruna, Sweden, is now in Liberia as technical leader for the Liberian-American-Swedish Minerals Company (Lamco). He is responsible for the project department and all civil engineering works.

James A. Maloney was recently named Minister of Mines at Ontario, Canada. He succeeds the **Hon. J. W. Spooner** who is leaving the post to devote all of his attention to the Lands and Forest department. The new minister of mines is a native of Eganville, Ontario. He graduated from Osgoode Hall, was called to the Ontario Bar in 1928, and is a member of the Ontario legislature.

C. A. Beukers, mining engineer with N. V. Oost-Borneo-Maatschappij, has recently returned to Holland.

E. E. Leitch, of Martin Place, Sydney, Australia, is leaving New Caledonia to take the position of mill superintendent for South Alligator Uranium in the Northern Territory.

Cornelis Bloot, mine geologist, formerly in Bolivia, is now in Arnhem, The Netherlands.

J. S. Smart, Jr. has been appointed general sales manager of American Smelting and Refining Company. Mr. Smart was active in the development of copper operations at Mount Isa Mines Ltd., in Australia, and he has made numerous trips to Queensland in connection with this project. **Ralph L. Wilcox** has been named assistant sales manager.

Charles Thurman and **Floyd Blanchard**, San Francisco, California, dredging consultants, were scheduled to leave for London, England, in mid-January. After meetings there with officials of **Pompiano Dredging Company** and **Sarakreek Goldfields**, they will fly to

EDWARD MCL. TITTMANN has been elected chairman of the board and chief executive officer of Southern Peru Copper Corporation. He formerly served as president of the organization. Mr. Tittmann joined American Smelting and Refining Company in 1929 following his graduation from Massachusetts Institute of Technology. He was with ASARCO at Garfield and Salt Lake City, Utah; East Helena, Montana; El Paso, Texas; and as general manager of Western Smelting and Refining Department before his association with Southern Peru Copper Corporation. **Kuno H. Doerr, Jr.** was named to succeed Mr. Tittmann as president of Southern Peru Copper.



Sierra Leone with **Brigadier Westrope** to check and inspect **Pompiano's** connected bucket line dredge which will be moved to **Sarakreek's** gold place on the **Lawa River**, **Surinam**.

Norman Whitmore, Minerals Engineering Company of Los Angeles, California, has returned to Turkey via the Polar Route, where he examined several mines enroute.

Hod Groff, assistant superintendent, has been promoted to superintendent of the **Hayden**, **Arizona** plant of the American Smelting and Refining Company. He recently returned from **Australia** where he was superintendent of the **Mount Isa** plant for ASARCO. Mr. Groff succeeds **Frank Downey**, who retired recently as superintendent after 34 years' service with ASARCO. A graduate of **Johns Hopkins University**, **Downey** worked for the company in **Selby**, **California**; **Garfield** and **Murray**, **Utah**; the **Mount Isa** plant in **Australia**; and **Hayden**.



HARRY F. MCFARLAND, consulting mining engineer of **Denver**, **Colorado**, is now on assignment for the **International Labour Office** in **Rangoon**, **Burma**. He is advising the **Burmese** government and teaching mine engineering in the newly formed mining department of the **Government Technical Institute**. Mr. McFarland and his family expect to return to **Denver** by way of the **Mediterranean Sea** and **Europe** in **April**. The above picture shows Mr. McFarland and his third (final) year students in their classroom at the **Government Technical Institute**.

BORIS SERNING, former mining superintendent for Luossavaara-Kiirunavaara AB, Kiruna, Sweden, is now technical leader of all mines belonging to Trafik AB Grangesberg, Oxelösund, Sweden. Mr. Serning is a graduate of the Swedish Royal Institute of Technology, in Mining Engineering. He assumed the duties in his present post on October 1, 1958.



Mort D. Turner, former chief geologist for the Puerto Rican Economic Development Administration, is now a consulting geologist in Hato Rey, Puerto Rico.

Edward T. Knight was recently named vice president of the New York and Honduras Rosario Mining Company's subsidiary, Rosario Explorations, Ltd., in Montreal, Canada.

Directors of the newly formed Hard Metals (Canada) Ltd. are P. J. Oppenheimer, chairman, Diamond Trading Corporation, London; E. T. S. Brown, managing director, Boart & Hard Metals S. A., Ltd., Johannesburg; P. J. Crokaert, Johannesburg; and A. R. Campbell, chairmen of Boyes Bros. Drilling Company. Boyes Bros. Drilling Co., of Vancouver, B.C. has become associated with the Anglo American subsidiary and DeBeers organizations of South Africa in this new Canadian venture.

Dr. H. Malissa, engineer in the West German consulting bureau Wedexro, has recently been in Indonesia for a three-month stay. The purpose of this visit was to make accurate surveys of projects for the set-up of steel industries which will be built in the framework of the Indonesian five-year plan.

Obituaries

Kenneth Cooke Brownell, 55, chairman of the board of American Smelting & Refining Company, died recently in New York. Mr. Brownell joined ASARCO in 1927 and came up through the ore purchasing and sales departments to vice president in 1936, executive vice president in 1947, and president in 1949. He was elected board chairman and chief executive officer in April 1957.

Lawrence W. Allen, general manager of Nchange Consolidated Copper Mines, Ltd., Chingola, Northern Rhodesia, died recently at his home in Chingola. Mr. Allen had been associated with Nchange for nearly 20 years, beginning in 1938 as underground surveyor. He received his Mine Manager's Certificate in 1943, and in the following years served as technical assistant to the manager, assistant underground manager, underground manager, assistant manager, and acting general manager of Rhokana Corporation. In 1956 he was appointed general manager of Nchange.

J. M. Shields died recently in Grand Rapids, Minnesota. Mr. Shields, who had served with Pickands Mather & Co. since 1919, retired as assistant superintendent of West Hill mine.

Roy W. Moore died recently following a long illness. Mr. Moore, who was active in the mining industry for nearly 47 years, had been associated with Goodsprings Anchor Company at Jean, Nevada, United Eastern Mine at Oatman, Arizona, and for many years served as president and director of Coronado Copper & Zinc Company, Los Angeles, California.

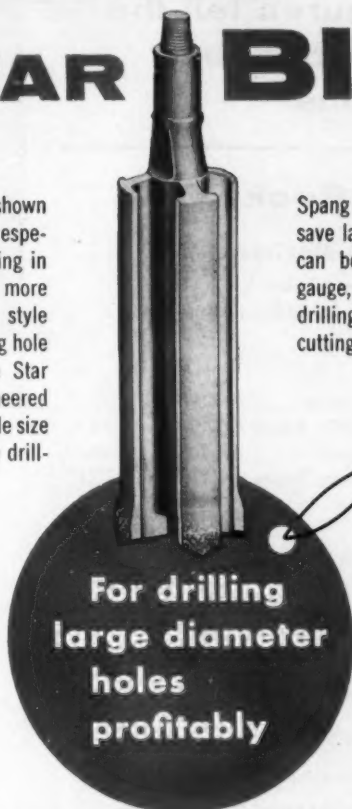
Gust Weggum, after whom the Weggum mine of the M. A. Hanna Company, Hibbing, Minnesota is named, died recently. Mr. Weggum, who had been associated with M. A. Hanna and its predecessor, Butler Brothers Mining Company, for most of his life, retired several years ago as mechanical supervisor.

Frank F. Grout, former geology professor at the University of Minnesota, died recently at the age of 78 years. Following retirement from formal teaching at the University of Minnesota in 1948, Mr. Grout spent short periods teaching at the University of Florida, California Institute of Technology, University of Arizona, and Columbia University.

Thomas M. Bains, mining and metallurgical engineer, died recently at the Veterans Hospital in Napa, California. Mr. Bains had been active in various mines in California, Arizona, New Mexico, and Mexico, and at the time of his death, was engaged in mining near Whitlock, California.

FABRICATED STAR BITS

The Fabricated Star Bit shown here has been designed especially for big hole drilling in hard formations. Far more efficient than the old style spudding bit and the big hole paddle-type bit, these Star Bits are custom-engineered to suit the particular hole size and the capacity of the drilling machine used.



Spang Fabricated Star Bits save labor and money. They can be quickly dressed to gauge, and speedily ready for drilling, by hard surfacing the cutting edge.

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MESABI RANGE TESTS PROVE

D9 and KELLEY RIPPER break frozen overburden better and faster than blasting—for less than the cost of explosives alone

Cost figures tell the story in toughest conditions

Frozen Rocky Clay

DRILLING AND BLASTING

Block: 4,635 square foot area
153 four-foot-deep holes, four-and-one-half-inch diameter.

Labor required:

3.1 Shifts, Driller	@ \$19.20	\$ 59.52
3.1 Shifts, Driller Helper	@ 18.16	56.30
0.6 Shift, Blaster	@ 20.24	12.14
0.6 Shift, Blaster Helper	@ 17.12	10.27
		\$138.23

Explosives Required: 195.00

Machine Expense:

3.1 x 8 = 24.8 hours of pneumatic drill	@ 3.35	\$3.08
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Estimated Cost: Drilling and Blasting \$416.31

RIPPING

Same area, same material

Method: D9 Tractor and Kelley Ripper—8 hours

4 initial passes, one cross-ripping pass

Doze off first layer and repeat process once

8 x \$21.63 173.04

Estimated Daily Savings—Ripping instead of blasting \$243.27

Days for D9 and Ripper to pay for itself 225 days

SUMMARY: The D9 and Kelley Ripper breaks frozen areas faster and more economically than any other method.



Those are the figures. The D9 and Kelley Ripper broke this frozen material into bite-size pieces for power shovels at a cost of only 20¢/yard, a total cost of only \$173. This is less than the cost of explosives alone. And it was 58% less than the total cost of drilling and blasting.

And this was in some of the toughest material a ripper can encounter. The sandy clay was heavily embedded with boulders up to one yard in diameter. One test block was frozen five feet deep.

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LATIN AMERICA

PERU—Northern Peru Mining and Smelting Company is reported to be interested in lead-zinc prospects in the San Pablo and Chilete districts of Cajamarca province. The firm, a subsidiary of American Smelting and Refining Company, already operates the Chilete lead-zinc property in the same province.

URUGUAY—A group of German experts are visiting Uruguay at the invitation of the Uruguayan government to look over iron and manganese deposits. Three mining companies have already been formed to mine these deposits. If arrangements can be made to sell the ore to Germany, the Uruguayan government would build a railroad from the mines to the river port of Fray Bentos so that ocean shipments could be made.

BOLIVIA—During the first quarter of this year, the same restrictions on export and production of tin by Bolivian companies are being followed as in the last quarter of 1958. This is in accordance with the International Tin Council's quota for Bolivia of 4,047,935 fine kilos. The individual quotas set are as follows: **Corporacion Minera de Bolivia**—3,292,469 fine kilos; **Banco Minero de Bolivia (Min. Chica)**—422,078 fine kilos; **Mineria Mediana**—333,388 fine kilos. The quota for Mineria Mediana has been divided among its member companies as follows: **International Mining Company**, 74,796 fine kilos; **Fabulosa Mines Consolidated**, 63,057; **Tihua Mines**, 51,477; **Empresa Minera Cerro Grande** 67,009; **Bolivian Tin Corporation** 11,405; **Empresa Minera Porco**, 6,490; **Empresa Minera Totoral**, 8,922; **Empresa Minera Ocuri**, 9,570; **Empresa Minera Avicaya**, 25,722; **Devon Corporation S.A.**, 6,750; **Cia. Minera Cruz Roja**, 6,190.

CHILE—Recent underground work by the **Sociedad Minera de Quetana** near Calama has exposed a copper sulfide zone. Plans are being made to install a flotation mill, but no date has been set for this. The **Quetana** mine is unique in that it is one of the only mines in the world that has **kroehnite** [$\text{Na}_2\text{Cu}(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$] as its chief mineral. The present milling is a leaching operation of 100 tons per day capacity. Present mine production is mainly oxide copper, but some sulphide ore (chalcocite and covellite) is hand sorted to about 25 percent copper for direct shipment. The operation is under the management of **Senor Juan Bacovic** of Antofagasta.

MEXICO—The **Fresnillo Company** is sinking its new **Fortuna** shaft from surface near the northwestern end of its present workings in the state of Chihuahua. The 3,000-foot shaft is expected to speed exploration of that part of the vein zone which is now difficult to reach through existing shafts. As of June 30, 1958, sulphide ore reserves in the **Fresnillo**, **Plateros**, and **Naica** mines were estimated at 5,786,300 tons.

CHILE—An 80-ton-per-day copper leaching plant has been opened by the **Nippon Mining Company** north of the port of Antofagasta. Ore will be hauled 15 kilometers from the **Portezuela** mine to feed the mill. The plant will serve as a pilot operation to gain experience with

Chilean oxidized minerals. (See **MINING WORLD**, January 1959, page 69 for other details of this Japanese operation.)

DOMINICAN REPUBLIC—**Mitsui Mining Company** recently sent another Japanese geological survey team to the Dominican Republic to study possibilities of developing the iron ore deposits in the **Hatillo** area. A similar mission was sent last year to study the quality of the ore and transportation facilities. The new survey is to determine the quantity of ore present, and then plans are to be made for full-scale development. Affiliated with **Mitsui** in the project are other **Mitsui**-controlled firms, such as **Daiichi**, **Bussan**, **Mitsui Steamship**, **Mitsui Bank**, and **Mitsui Shipbuilding and Engineering Company**.

JAMAICA—Construction of **Alumina Jamaica's** second plant, near **Ewarton**, has been allowed to slow down over the past few months because of a surplus in the alumina industry. The \$35,000,000 plant will probably go into operation sometime this year, instead of in 1958 as originally planned, and will produce 250,000 tons per year.

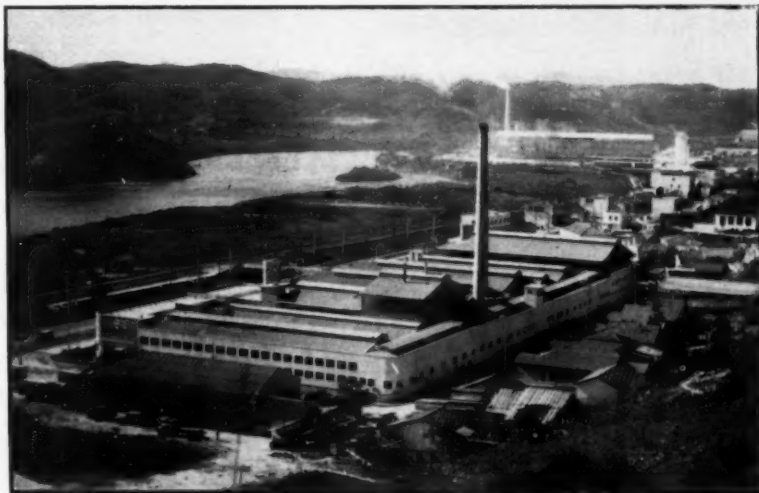
CHILE—There has been an increase in the buying price paid by the **Caja Credito Minero (CACRIME)**, or **Miners Credit Bank of Chile**, for copper, lead-zinc, silver, and gold ores and concentrates. This was caused by the recent freeing of the dollar exchange by the Chilean government. The **CACRIME** initiated a program years ago for the purchase of minerals from small miners in order to stimulate production and bolster the economy among the provinces which depended primarily upon mining. At the same time, the agency enacted a straight 2 percent tax on sales of ores and

concentrates as an added incentive. Due to the fluctuating exchange and government controls on this exchange, however, this will be the first time since 1948 that the miners have received close to the true value for their products. The **Caja Credito Minero** at the present time is buying copper, lead-zinc, silver, gold, and manganese ores and concentrates.

PERU—The joint venture team of **Compania Utah Pacific Ltd.** and **Compania Constructora Emkay del Peru**, subsidiaries of **Utah Construction Company** and **Morrison-Knudsen Company Inc.**, expects to have its phase of the **Southern Peru Copper Corporation** project at **Toquepala** completed by December 1, 1959. First copper deliveries will follow closely behind. Major work assigned to the team under an \$80,000,000 contract has included erection of the ore crushing and flotation mill near the mine; erection of a modern smelter at the port of **Ilo**; installation of warehouses, rail yards, townsites, and other supporting facilities, both at the mine and at the port; construction of a 130-mile standard gauge railroad between the mine and port; and erection of a 44,000-kilowatt steam power plant, complete with transmission line.

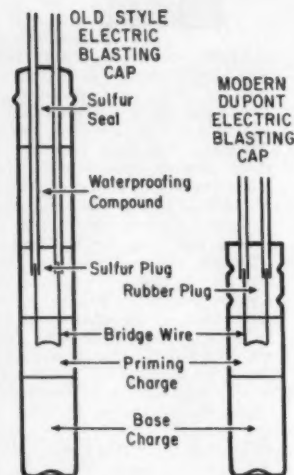
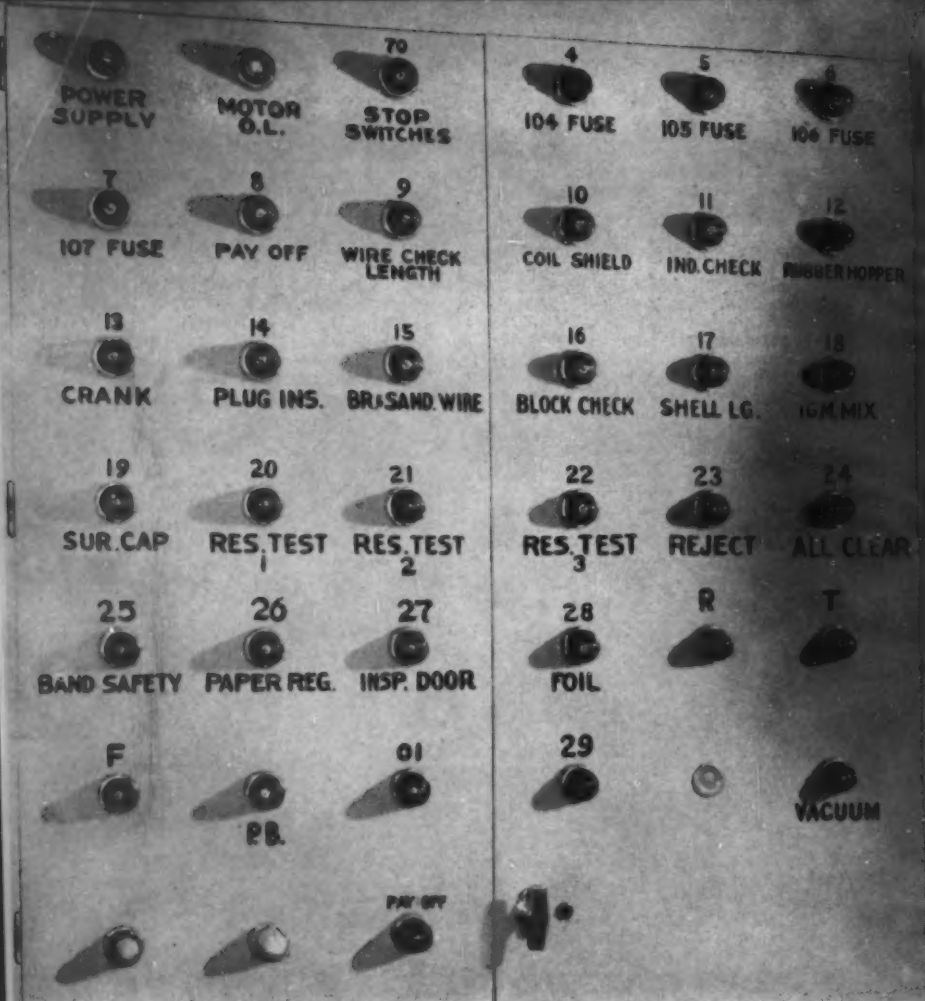
MEXICO—The **La Reforma** mine has been optioned for \$375,000 by **Sheep Creek Mines, Ltd.** of **Vancouver** and **Nelson**, **British Columbia**, Canada, which already has started exploratory drilling. The limestone replacement ore body contains values in silver, lead, zinc, and copper.

CHILE—In one of the first definite moves of Canadian mining interests to Chile, **Howard S. Strouth**, a founder and



CESBRA Makes Additions to Brazil Tin Smelter

This is an aerial view of the **Volta Redonda** plant of **Companhia Estanifera de Brasil (CESBRA)** in Brazil which has been modernized and expanded so that it is now capable of treating tin concentrates from any source or of any composition. The initial wood-fed furnaces have been replaced by oil-fed revolving furnaces. An electrostatic filter has been installed both for gas purification and for impurity preparation. Storage silos have been constructed, and a 40-meter draft chimney has been erected for exhaustion of the combustion products. The reduction furnace has been increased to six units, five of double-phase type and one with single phase. The refining plates are now oil fed. The electrolytic refining process takes place in concrete tanks lined with polydurite. All of the metal produced by **CESBRA** is destined for Brazilian markets for production is still well behind the country's demand. For this reason, it will be some time before Brazil considers exporting tin.



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president of the Stanleigh Uranium Mining Corporation, Ltd. of Toronto, has organized the Cia. Minera San Felipe in Santiago. This company has taken control of a copper sulfide property called Andacolla near Putaendo in Aconcagua Province which has been inactive for over 40 years. Plans are to clean the old workings and commence with a production of about 20 tons per day which, according to Mr. Strouth, will allow time to complete the exploration of the deposit.

ARGENTINA—Four recent ore discoveries have been made in Tucuman Province. The first is gold, silver, and manganese oxide (calcite gangue) in Sierra de la Ramada; the second is gold and silver (in several gangues) in a zone of metamorphic rocks of Rio Seco; the third is beryl occurring in pegmatites of the Cerro Munoz; and the last is rare earths in Valle de Tafi. Prospecting will be intensified.

CHILE—A titanium-zirconium beach sand deposit has been discovered on the west coast of the island of Chiloe about 200 miles south of Puerto Montt. The deposit is reported to be deep and investigation to date reportedly has revealed in excess of 200,000,000 cubic yards of material. Owners of the deposit say that exploration will continue this summer, and they plan to install a dredging operation there in the near future.

PERU—Instituto de Investigacion y Fomento Minera and Banco Minera del Peru are studying the possibilities of installing a central smelter and refinery for lead and zinc produced in Peru. The scale should be between 150 and 200 metric tons a day for each. Main problems are supply of metallurgical coke, generation of electric power, definitive best location, and raising of necessary funds.

ARGENTINA—Hunting (Argentina) S.A. and an associate company, Aeroexploracion S.A., have been set up in Buenos Aires to carry out aerial photography and geophysical work. Through Aeroexploracion, local facilities for mosaicing and mapping are available, as well as airborne geophysics. The other firm offers photogeological services. Both are part of the world-wide Hunting Group of Air Survey Companies.

CHILE—The government agency, Sociedad de Minerales Radioactivos, reportedly will undertake development of six uranium deposits. According to Emilio Gonzalez, Minister of Mining, the government is interested in obtaining foreign capital for investment in the mines.



FINLAND—A deposit estimated to contain 2,000,000 metric tons of copper and zinc ore has been discovered by Ruskealan Marmorit Oy, a Finnish company. The ore assays 1.5 percent copper and 1.0 percent zinc, according to the reports, and also contains appreciable amounts of silver and nickel. A plant is to be erected and its output shipped to Jaunkoski or Sysmajarvi for smelting.

EIRE—Can-Erin Mines Ltd. has started a drilling program from a station in the Old Ship shaft at its Mountain mine.

Three holes will be fanned to prospect the North-South ore body at the 1,200-foot horizon, and later, down hole drilling will be undertaken when a station is developed from the bench on that horizon. Channel sampling of the new bench on the 1,200-foot level has been completed. It averaged 6.84 percent copper over an average width of six feet for a sampled length of 100 feet.

ITALY—An Italian commission left Milan toward the end of last year for Liberia and Ghana. The group will investigate the possibilities of investing in mining concessions for graphite, mica, iron, and quartz production. They will also consider the possibilities for opening an Italian bank, and possible participation in the Volta River dam and power plant project.

UNITED KINGDOM—A study of the potentialities of metalliferous mining in the United Kingdom, including the practical steps to be taken in developing ore deposits, is to be made by Dr. K. C. Dun-Durham University, on behalf of the United Kingdom Metal Mining Association. Depending on Mr. Dunham's report, the Association intends to approach the government with a view to obtaining tax concessions to encourage the development of metallic ores in the British Isles.

SPAIN—A new mining company, Honigmann & Krupp, will develop the San Jose iron ore Deposit in the province of Leon. Mr. Honigmann was the promoter of the Vivaldi mines which, together with the Wagner mines, are the main suppliers of iron ore in exchange

for mining machinery under the Kirckfeld arrangement.

RUSSIA—Production of nonferrous metals in the first nine months of 1958 was 11 percent higher than during the same period of 1957. During 1958 some of the newly discovered deposits of nonferrous metals were brought into production. In East Kazakhstan, the first shipments of ores were made from deposits claimed to be exceptionally rich in lead, zinc, copper, and rare metals. Kazakhstan is also scheduled for development as one of Russia's foremost nonmetallic producers. Its resources include bauxite (which will be the basis for a new aluminum industry already under development), asbestos (production of which is expected to start in 1961), and manganese.

UNITED KINGDOM—During the past few years a great deal of airborne geophysical prospecting has been undertaken covering the iron ore deposits of the Jurassic system, the whole of the Isle of Man which was a prolific producer of lead, zinc, and silver, and certain parts of Cornwall. In Cornwall the extent of the kaolinization of granite areas has been mapped by ground geophysical methods by one of the China clay companies. The clay industry has also carried major developments in processing in recent years, and the results of one company's experimental work on the use of cyclones in refining the clay has been published.

BULGARIA—Soviet geologists are reported to have discovered uranium de-



USSR Concentrates on Aluminum Production

Long-range government plans, concentration of manpower and materials, and available natural resources have made the Soviet Union the fastest growing aluminum producer in the world today. Since 1932, when the first Russian aluminum plant (Volkhov) was constructed, production has increased from 1,100 tons per year to an estimated 710,000 tons annually from Russia and her satellite nations. Russia claims to possess extensive deposits of aluminum ore, but size and quality of reserves has not been released. Rich bauxite deposits in Hungary are available to Russia, and it is believed that considerable bauxite exists in Russia itself. The Soviets also use nepheline-syenite and alunite as sources of aluminum. No exact figures are available on the number of alumina and reduction plants currently controlled by Russia; however, reports indicate plants are in operation at Volkhov, Zaporazhye, Kandalsaksha, Kamensk-Uralsky, Krasno-Turnisk, and Stalinsk. New plants are believed to be under construction or in production at Sumgait, Yerevan, Irkutsk, Krasnoyarsk, Stalingrad, Achinsk, Nadvosty, and Tikhvin. These are in addition to plants operating in Hungary, Poland, China, East Germany, Czechoslovakia, North Korea, and Rumania. Total present capacity of the reduction plants in the Soviet satellites is an estimated 286,000 annually. By 1961, it is predicted that the Soviet Bloc will produce 1,430,000 tons of aluminum annually. A typical Soviet mining camp is pictured above. The town, called Severo-Uralsk, was built by Russians during World War II, and is located near bauxite mines in the Northern Urals.

posits about 70 kilometers from the Bulgarian capital of Sofia. Development work is said to have started already. The Soviet Union is also reported to be very interested in cobalt deposits recently discovered.

YUGOSLAVIA—Two Short-Drum furnaces have been installed by the **Lurgi-Chemie** of Frankfurt in the lead smelters at Mezica, Slovenia, introducing a new production process. Until now, two-thirds of all Yugoslavian lead had been produced in Newman hearth furnaces and one-third in blast furnaces. In August 1958, the Short-Drum furnaces were started in test operations, treating sintered and raw concentrates. The direct lead extraction is much higher than that of the Newman furnaces.



LABRADOR—Ross Toms, well known Arctic prospector, reportedly has found a large low-grade iron ore deposit while exploring the Labrador concession area held by **Newfoundland-Labrador Exploration Syndicate**. The deposit is in area extending from the Hudson Straits, 220 miles south along the Atlantic coast of Newfoundland to Hebron, and inland to the Quebec border. On his recommendation, the Syndicate has applied for the Southern Boundary Concession which runs along the northern Quebec border.

The Syndicate is headed by **Cyrus Eaton** of Cleveland. Present membership includes: **Technical Services Inc.** (the Eaton organization); **R.K.O. Theaters**; **Scurry-Rainbow Oil Company**; **T. H. Jones & Company**; **G. Maxwell Bell**; **Frank McMahon**; **T. H. Jones**; **W. G. Gilmore**; **David R. Williams, Jr.**; and **R. C. McDowell**.

BRITISH COLUMBIA—Pending approval by stockholders, **Bralorne Mines Ltd.** will take over and operate **Pioneer Gold Mines Ltd.** in the Bridge River area of British Columbia where the companies operate adjoining properties. Shareholders of Pioneer will receive one share of Bralorne for each five shares of Pioneer. Bralorne recently cut the "77" vein on its deepest level—the 35th level.

MANITOBA—**Panther International Mining Company Ltd.** is undertaking a 10,000-foot diamond drill program on its property in the Mystery Moak nickel belt area. Surface geophysical-geological crews have been following up on the results indicated by an airborne geophysical survey. Sixteen drill targets have been selected thus far. Panther International is under sponsorship of the J. H. Hirshhorn interests.

ALASKA—Mineral production in 1958 dropped an estimated 30 percent over the preceding year, based on preliminary figures. The decline was caused chiefly by a lack of uranium production, and the decrease in production of sand, gravel, coal, and stone. There was also a lack of chrome production, and a decline in mercury output. Only the price of gold held steady, but Alaska's gold output is expected to decline to about half in the

next few years if the present price and cost trends continue. The **U.S. Smelting Refining & Mining Company**, Alaska's largest producer, has already announced that its operations at Fairbanks and Nome will close down in 1963 or 1964 under present economic conditions. The area's chief hope for increased mineral production now depends upon copper, nickel, iron, and coal resources.

GREENLAND—Reports from Copenhagen indicate that the Danish shipping firm of **J. Lauritzen** has bought up all of the Canadian shares held by **Frobisher in Northern Mining Company**. The latter operates a lead and zinc mine at **Mesters Vig**, and its concentrates have been shipped to Europe and the United States by the J. Lauritzen shipping lines. Danish interests now control the company, since the Danish government originally contributed 27% percent of the capital; Danish companies, another 27%; Frobisher 15; and two Swedish concerns, the balance. These are **Bolidan Gruvaktiebolag** and **Store Kopparbergs Bergslags Aktiebolag**.

BRITISH COLUMBIA—**Blue Star Mines Ltd.** of Vancouver has started extending the 1100-foot Matheson Tunnel at the **New Wellington Mines, Ltd.**, property at Retallac. Objectives are two veins within 500 feet to get 350 feet additional depth below former workings. The company spent \$70,000 in renovation work, which included reopening, enlarging, and retimbering the tunnel, and constructing a compressor building and other camp facilities, including a snow shed over the track. **T. R. Buckman** has been in charge. **Edward L. Borup** of Vancouver is president of **Blue Star Mines**.

QUEBEC—A low-grade taconite property has been leased by **Oglebay Norton Company** of Cleveland, Ohio from **Atlin-Ruffner (B.C.) Ltd.** Large reserves containing about 25 percent iron are said to be suitable for open-pit development. The property is near Amos, Quebec. The firm had previously drilled the **Doran Lake** low-grade property in Ontario owned by **Lun-Echo Gold Mines, Ltd.**, but this has been abandoned.

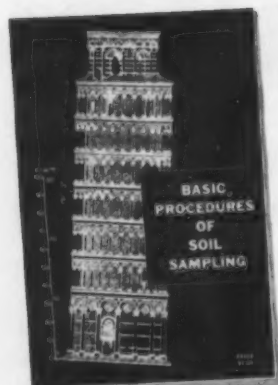
ONTARIO—**Jonsmith Mines** has revealed the discovery of molybdenite in **Derosiers Township** about 30 miles northwest of Gogama. The discovery group consists of 20 claims, and the firm has optioned another 12-claim block nearby. The discovery was located in a granitic dike within a basic schist. Surface trenching is underway and diamond drilling is to start soon.

BRITISH COLUMBIA—**Bethlehem Copper Corporation** has completed the first phase of its 10,000-foot exploration program in Highland Valley. The company's adit at elevation 4,600 feet entered the fringe of the Jersey copper deposit after a 2,700-foot drive from the portal. An additional 1,000 feet of underground work will be undertaken by **Intermountain Construction Company**. Concurrently with penetrating the Jersey zone, long holes will be driven parallel to the tunnel by the percussion method. Extension of the tunnel to the East Jersey Zone will mark the second phase. By fall the company hopes to have complete information on the copper content of both deposits. The bulk sampling plant is ready for operation.

NEWFOUNDLAND—**Pickands Mather & Co.** has announced that the four groups developing the **Wabush Lake** iron property about 200 miles north of Seven

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Islands will build a 42-mile railway to connect with the Quebec North Shore and Labrador Railway. The new line will serve the 3.5-square-mile property which Wabush Iron Company leases from Canadian Javelin. It will be operated by Wabush Lake Railway Company Ltd., a subsidiary of Wabush Iron Company; both are managed by Pickands Mather. Wabush is owned by PM, together with Youngstown Sheet and Tube Company, The Steel Company of Canada, and Interlake Iron Corporation.

BRITISH COLUMBIA—Newmont Mining Corporation will develop the Trojan copper property in Highland Valley, owned by Trojan Consolidated Mines. The shaft will be dewatered, and the present underground workings used for diamond drill stations. Under the arrangements, Newmont will acquire 70 percent interest in profits, subject to repayment of some of Trojan's preproduction expenses and compensation for camp and equipment out of first production.

ONTARIO—Stockholders have approved a merger of Continental Mining Exploration Ltd. and Canadian Lithium Mining Corporation Ltd. The new firm will be known as Canamines Exploration Company Ltd. Among the benefits of the merge is a consolidation of holdings in Faraday Uranium Mines and Capital Lithium Mines.

BRITISH COLUMBIA—Amalgamated Resources has acquired from Goldmont Porcupine Mines Ltd. the controlling interest in Jericho Mines Ltd. Ore has been uncovered in the Highland Valley property at intervals for 1,000 feet, averaging from 2 percent to as high as 56 percent bornite copper.

SASKATCHEWAN—The W. S. Kennedy Grubstake 1958 has been granted a permit to search for metals in a 6,000-square-mile area around the William River. The firm plans to spend \$400,000 on magnetometer and other surveys over a four-year period.

QUEBEC—A new firm has been formed as the result of an agreement between Consolidated Marbenor and Malartic Goldfields Ltd. The new name is Marban Gold Mines Ltd. Marbenor has transferred its 27-claim gold prospect in the Malartic area to the new company which will undertake sinking of an 800-foot shaft and such lateral development work as is recommended by the new company's engineering department.



AFRICA

FEDERATION OF RHODESIA & NYASALAND—Bancroft Mines Ltd. will resume production on April 1 on ore drawn from the higher grade No. 1 Shaft area in the Kirila Bomwe ore body. Since April 1958, development has been concentrated in this area, and further drilling from surface has disclosed additional ore. Sufficient ore can be drawn from the No. 1 Shaft area to maintain a treatment rate of 150,000 tons per month, without drawing ore at this stage from the lower grade Konkola ore body, which is served by the No. 2 Shaft. The surface plant is expected to be operated at its rated capacity in the second half of 1959, which

will result in production of about 50,000 long tons a year of copper.

UNION OF SOUTH AFRICA—Cape Asbestos Company Ltd. has acquired all of the stock of Consolidated Blue Asbestos Corporation (Pty.) Ltd. which operates blue asbestos mines in Cape Province between Kuruman and Postmasburg. This will not only provide Cape Asbestos with additional asbestos fiber but will also considerably strengthen its fiber reserves. Cape Asbestos is the world's largest producer of blue crocidolite asbestos. Through its subsidiary, Cape Blue Mines (Pty.) Ltd., it operates blue asbestos mines at Koegas and Westerbeg on the Orange River in Cape Province, at Pomfret on the border of

Bechuanaland, and at Malips Drift in the Transvaal.

GHANA—A new mining company, Ghana Minerals Corporation, has been formed under the auspices of Camp Bird Ltd. to acquire Ghana's mineral rights for the next 50 years. The Ghana government, however, is reported to have issued a statement saying that the approval of this plan was made without the necessary authority. This has aroused much comment in Ghana and the United Kingdom, and dealings in Camp Bird shares were suspended by the London Stock Exchange Committee pending clarification. Camp Bird has now advised the Ghana government it is withdrawing its proposals regarding Ghana's mineral rights

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"in view of the contradictory statements which have appeared in the press apparently emanating from the Ghana government."

UNION OF SOUTH AFRICA—Buffelsfontein Gold Mining Company Ltd. has completed extensions to its gold plant. Overall rated capacity is now 160,000 tons per month, and treatment rate is about 130,000 tons. Mining and hoisting capacity are being increased. The program includes sinking of a sub-vertical shaft from 4,930 to about 7,525 feet below surface to open up the deeper levels down dip from the present workings in the northwestern section. This shaft is being sunk about 3,000 feet south of the existing shaft system. Extensions to the pyrite and acid plants to capacities of 120,000 tons per month and 250 tons daily, respectively, have been commissioned. Capacity of the uranium plant is adequate for the present output quota of 191,750 pounds of U_3O_8 per quarter, and for an additional 21,500 pounds per quarter to which the mine will become entitled on any upward revision of the quotas.

SOUTHWEST AFRICA—Industrial Diamonds of S.A. (1945) Ltd., which owns diamond-bearing deposits at Saddle Hill in the Luderitz district, has decided to convert its operations to dredging because of the reduced prices for industrial diamonds. It is expected that dredging will reduce working costs from 43½ pence per load to about 12 pence. Dredging and related lower costs will enable the company to develop the strip between the low and high water marks and the inland terraces below sea level, which previously proved too costly to develop

by conventional methods because of the heavy influx of water. The firm also holds the mining rights to an area of 9,000 square miles extending south from about 20 miles north of Conception Bay.

FEDERATION OF RHODESIA & NYASALAND—Cam & Motor Gold Mining Company Ltd. has acquired the mining claims belonging to Eileen Alannah Gold situated adjacent to the Cam & Motor mine. A development option has been secured on the Mid Winter mine located between the Pickstone and Cam & Motor mines. The sulphide zone of the new property is being explored to ascertain the advisability of exercising the option.

UNION OF SOUTH AFRICA—A special investigation is being conducted by Stoltzberg Asbestos (Chrysotile) Holdings Ltd. into the ore reserves of its mine, mining methods to be employed, and the merit of increasing milling facilities. The asbestos deposits occur in an area of about 1,330 acres, in which ore reserves of 1,543,422 tons have been proved with a recoverable fiber content of 2 percent which is equivalent to 10 years' milling at the rate of about 150,000 tons per year. In two other sections, potential reserves have been estimated at up to 2,000,000 tons or more. Exploratory development in these two sections is now underway to determine more accurately the tonnage of ore, the fiber grades, and the percentage of recoverable fiber. An adit will be driven across the general strike to the center of the ore-body, with drives to be advanced on both sides along the strike. This will provide bulk samples for milling tests. Installations forming the preliminary stages of the expansion pro-

gram have already been started, and include a standby 1,000-kw steam-turbo alternator.

FRENCH WEST AFRICA—The Spanish government and the French mining company of MIFERMA (Société des Mines de Fer Mauritanie) with interests in iron ore deposits in Mauritania have reached an agreement by which the French company may build and operate a railroad through the Spanish territory of Rio de Oro (Sahara). Negotiations are still underway regarding the transit fee to be paid the Spanish government, based on annual production of 4,000,000 tons initially, and 6,000,000 tons later. The Spanish are also reported to be seeking a four percent share in Miferma's capital. At present the company is held by French interests (51 percent), British Iron and Steel Ltd. (20 percent), the Italian firm of Finsider (15 percent), and German interests (10 percent). Construction of the railway is to start shortly, and production is to begin in 1962. The route through Spanish territory saves about 70 kilometers off the length of the railway and saves expensive tunneling. A World Bank loan of \$60,000,000 is sought.

UGANDA—Kilembe Mines Ltd has announced a £900,000 expansion plan which will increase production, within three or four years, by 25 percent to a total of 15,000 long tons of copper per year.

TANGANYIKA—The proposed merger of The Zambesia Exploring Company Ltd. and Kentan Gold Areas Ltd. is of a type which is rather unusual in that it is designed primarily to reap the maximum advantages from Kentan's accumulated tax losses. To do this the smaller and less profitable Kentan company has made an offer for the larger and more prosperous Zambesia. Kentan's assets consist chiefly of its 78 percent interest in Geita Gold Mining Co. Ltd., a gold mine now yielding a profit of about £3,500 monthly as a result of the solution of this mine's metallurgical problems. Geita's future depends to a considerable extent on the result of four drill holes which are going to be drilled on the known orebodies at Geita and at the north-eastern extension.

FEDERATION OF RHODESIA & NYASALAND—The Ndola cobalt plant of Chibuluma Mines produced 6,645 tons of cobalt-copper matte in the fiscal year ended June 30, 1958. This matte is shipped to Belgium for final conversion into cobalt and copper. Rate of production is expected to reach 1,100 tons per month as the initial plant difficulties are overcome. Costs were higher than anticipated because of the erratic production, averaging about \$2.66 per pound on a delivered U.S. basis.

NIGERIA—Amalgamated Tin Mines of Nigeria Ltd. carried out extensive prospecting during the 1957-1958 fiscal year. A program of Banka drilling was carried out on over 46 mining leases and 12 exclusive prospecting leases. New cassiterite reserves of 857 tons were proved and a further 1,563 tons were added through redrilling of old blocks. Some Banka and power drilling was also conducted in the Gona area to assess the long-term possibilities of the lead deposits there. As a result, a considerable area may have to be more closely drilled in order to block out potential ore reserves more accurately.

UNION OF SOUTH AFRICA—As part of its present plans for development of

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the ultra-deep zone from about 8,000 feet, East Rand Proprietary Mines Ltd. has decided to dismantle its two existing obsolete reduction plants in stages. This will conform to the schedule of erecting a new centralized plant with an initial capacity of 140,000 tons a month, building up to 170,000 by about mid-1962. Cost savings and greater efficiencies will justify the £2,400,000 capital expenditure over the first seven years of operation. On the mining side, an additional £3,600,000 will be spent on ultra-deep development, including deepening both the Far East Subvertical and Southeast Subvertical shafts to depths of 9,600 feet, extending the line of sub-incline shafts to depth, and expanding the ventilation, cooling, and pumping facilities.

FEDERATION OF RHODESIA & NYASALAND—Mufulira Copper Mines has completed 25 years of production with an output of 1,680,000 long tons of copper worth £237,000,000. Ore reserves which totaled 116,000,000 at the start of operations in 1933, now total 169,000,000 tons.



SOUTH KOREA—An intensive aerial survey of South Korea should be completed soon. The survey being underwritten by United States Funds is cover-

ing a 9,000-square-mile rectangle in the northeastern quarter of South Korea. This area was selected by geologists as the most likely location for iron ore deposits.

INDIA—The Government of India has withdrawn the export duty on manganese ores to the great relief of both buyers and sellers. This action has come too late for many operators, however; India's traditional buyers have already arranged supplies from other countries. Some 26 manganese mines in Madhya Pradesh and Bombay have closed. If the railway freight rate is also reduced, some observers believe this will help to recoup the export loss.

MALAYA—Ayer Hitam Tin Dredging Ltd. is in a more favorable position than most Malayan tin firms regarding output restrictions. The company's sales quota is less severe than most because production at this one-dredge operation declined fairly sharply in the period taken as the basis for allotment of quotas. The decline in output was almost entirely the result of the dredge crossing comparatively low-grade ground. Now a second dredge is going into operation, for which a yearly allotment of 1,858 tons has been granted.

CEYLON—The Ceylon Mercantile Chamber is urging the Minister of Commerce and Trade to intercede for the graphite producers in the matter of waiving the export duty. It feels that this is the only way of reducing cost, and thereby permitting mine operators to compete successfully with foreign lead producers. The Minister of Finance has already refused the request. The Cham-

ber points out that graphite exports to the U.S. have steadily declined in the past three years, and the Australian market is practically lost. With an export duty as high as Rupees 50 per ton, Ceylon producers are unable to reduce prices enough to compete successfully on the world market.

PAKISTAN—The Central Government has decided to take over the recently established **Mineral Development Corporation** which is presently working under the provincial West Pakistan government. The action follows the transfer of the subject of mines and minerals from the provincial to the central list. Initially, emphasis will be placed on development of coal and metallic ore deposits. The corporation is also presently negotiating with a U.S. firm for the establishment of a plant for upgrading of chrome at Hindubagh. Ore samples have already been sent to laboratories in the U.S. and Japan for detailed analysis. About two lakh tons of low-grade ore, containing about 33 to 43 percent chrome, are stockpiled.

JAPAN—A 39-day strike at the Osaka copper refinery of **Mitsubishi Metal Mining Company** resulted in a loss of about 3,000 tons of electrolytic copper. This is expected to be made up through increased production during December 1958 to March 1959 of an additional 600 to 700 tons per month. This, in turn, will require the refinery to produce 3,800 tons per month.

SOUTH KOREA—The Mining Bureau of the Ministry of Commerce and Industry has reviewed a plan for resuming

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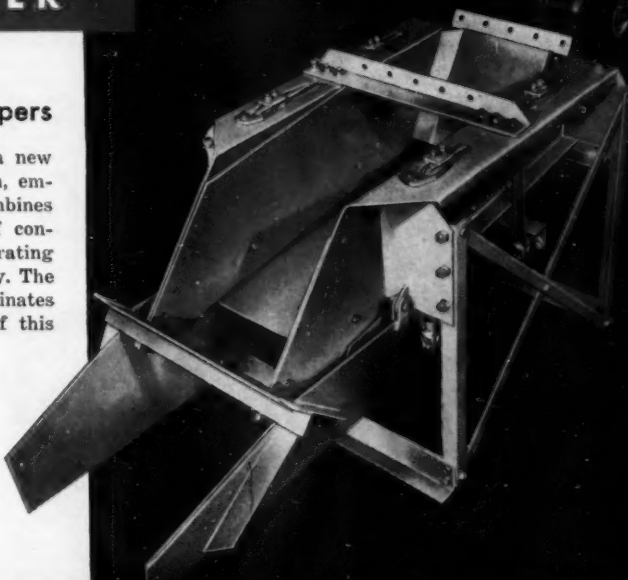
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production of tungsten by the **Korea Tungsten Mining Company**. Officials of the Bureau state that while it was decided to resume tungsten production in view of the favorable turn in international markets, the time for the resumption and the quantities of tungsten to be produced have not yet been determined.

INDIA—The newly organized **Directorate of Geological Survey** of the Government of Bihar will shortly undertake investigation into qualitative and quantitative reserves of limestone in the State. Some 5,000 samples of limestone will be examined for the purpose of its utilization in the manufacture of cement, calcium carbide, and other chemicals, and its use as fluxing material for the manufacture of steel. The directorate, which was set up in March, has already completed the geological, engineering, and hydrological survey of village Hatia and its neighborhood in Ranchi district where the heavy machine-building plant is going to be located. It is presently engaged in survey work in the Hatia area for the Indo-Czech foundry forge plant. Its work is expected to be completed by the end of this year. The State Government is also utilizing its services for locating sites for tube-wells and other reservoirs to solve the problem of water scarcity facing many parts of the State.



OCEANIA

NORTHERN TERRITORY—Commonwealth Aluminium Corporation Pty. Ltd. has been granted a special mineral lease of about 22 square miles in the Gove Peninsula. The area is known to contain substantial tonnages of bauxite, although much more testing is necessary to determine its commercial value. Under the lease terms, the company must make a thorough examination of the area within two years, and must submit a plan to the Commonwealth within five years for development and treatment of the ore. COMALCO has undertaken to make supplies of bauxite or alumina available, if required, to the Commonwealth government's smelter at Bell Bay, Tasmania.

REPUBLIC OF THE PHILIPPINES—The National Rice and Corn Corporation has recommended that the rice being

imported from the United States under a barter contract be re-exported upon arrival. The rice is exchanged for chrome ore and this is considered a necessary stimulation for the mining industry, but is no longer needed by the rice agency for stabilization purposes.

NEW ZEALAND—In the year ended March 31, 1958, **Kanieri Gold Dredging Ltd.** recovered 13,942 ounces of gold bullion from 4,264,000 cubic yards dredged, as compared with 9,146 ounces from 3,772,000 cubic yards dredged in the fiscal year of 1957. The firm's figures for the year reveal some interesting facts about dredging costs in New Zealand, compared with Australia. Kanieri reported costs for 1958 at 5.16 pence per cubic yard, and 5.08 in 1957. In Queensland, Australia where **Tableland Tin N.L.** has been working, this firm reports costs at 20.27 pence per yard in fiscal 1958, and 26.74 in fiscal 1957. **Tableland Tin**, incidentally, dredged 3,219,898 cubic yards for a recovery of 629 tons of tin in the year ended June 30, 1958, and 2,973,830 cubic yards for a recovery of 544 tons in fiscal 1957. In New Zealand, again, **Arahura Gold Dredging Ltd.** recovered 6,392 ounces of gold from 2,764,000 cubic yards, compared with 12,088 ounces from 2,887,000 yards in the previous year. Costs in the last year were 7.18 pence per cubic yard.

TASMANIA—**Aberfoyle Tin N.L.** at Rossarden milled 66,555 tons of ore in the year ended 30th June—an all-time record. A tonnage of 70,000 is aimed at for the coming year in order to lower costs as a result of depressed metal prices. The **Storey's Creek** mine, 3½ miles by road from Aberfoyle, has a new mill, and throughput will be increased from 300 to 1,000 tons per week. The necessary development will take about a year. Like Aberfoyle, **Storey's Creek** is a tin-tungsten deposit. Economies are expected from the merging of management of the two mines.

REPUBLIC OF THE PHILIPPINES—To test mercury-bearing structures at depths, **Palawan Quicksilver Mines** has drilled a series of x-ray holes up to 200 feet deep. However, one deeper drill hole approached a depth of 600 feet at year's end. A shorter hole drilled to 170 feet hit a cinnabar-bearing structure at a depth of between 60 and 85 feet. Another structure was cut at 140 to 155 feet.

NORTHERN TERRITORY—There is a note of optimism in uranium company

annual reports because of the contracts recently signed with the **United Kingdom Atomic Energy Authority**, **United Uranium N.L.** and **South Alligator Uranium N.L.** contracts provide sufficient sales of proved material to permit satisfactory profits and amortization of plants over the next few years. It is anticipated that demand for uranium will then be sufficient, even though prices will be lower, to permit the companies to compete on the world market. The Commonwealth government is building an all-weather road from Pine Creek to the South Alligator River area at a cost of £300,000. Several areas in the north and northeast parts of South Australia have been opened to uranium prospectors again, including Mount Painter, Olary district (except Radium Hill), Crocker's Well, Moorlands. The government will give "every assistance to interested parties."

BORNEO—A diamond mine reportedly has been opened in Central Borneo. Stones valued at 2,000,000 rupiahs have already been recovered, according to these reports.

NORTHERN TERRITORY—The Commonwealth Bank will lend up to £160,000 to **South Alligator Uranium N.L.** to build a small treatment plant for the production of uranium oxide. This company, with **United Uranium N.L.**, has a contract with the **United Kingdom Atomic Energy Authority**. The firm has reported 10,000 tons of ore with 100 tons of U_3O_8 ; the deposit continues in length and depth and little work has been done to prove it because of a lack of capital.

HAWAII—The U.S. Geological Survey has released a report on "Bauxite Deposits of Hawaii, Maui, and Kauai" by James B. Cathcart. Copies are available for consultation in the Department of Geology, University of Hawaii, Honolulu.

REPUBLIC OF THE PHILIPPINES—The Bureau of Mines has decided in favor of **Palawan Consolidated Mining Company** in a dispute over chromite mining claims. The firm's **Venture** claims allegedly overlapped claims located by **Apostol**, **Fabella**, and associates. The company will now resume its development work in the area where it has already stockpiled about 2,000 tons and partially blocked out another 8,000 to 10,000 tons.

NORTHERN TERRITORY—It is now officially admitted that the two original open cuts at **Rum Jungle** have ceased production after being depleted. Work at **White's Find** was abandoned in July and **Dyson's Find** ceased work in November. About 372,000 tons of ore have been stockpiled, sufficient to keep the treatment plant active for over five years. A new discovery of uranium ore has been reported at **Rum Jungle Creek** but drilling has not proceeded far enough to report tonnage, although the grade appears high. A small open pit at **Mount Burton** has also been worked out.

WESTERN AUSTRALIA—**Western Mining Corporation Ltd.** has formed a new company known as **Western Aluminium N.L.** to prospect its bauxite deposits in the Darling Ranges. Commercial grades of bauxite have been discovered in certain areas of the company's 6,250-square-mile reservation. A laboratory for analysis of field samples has been built at Kalamunda. A field party has been working on the company's **Tarrai River** copper properties since May, mostly on geophysical work. Diamond drilling will start on six of the ore bodies during the next dry season.

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volt
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COMPRESSORS

- 1 2200 cfm Ing. Rand Model PRE-2, 350
H.P. Synchronous Motor with all electrics
- 1 2470 cfm Ing. Rand Model PRE-2, 435
H.P. Synchronous Motor with all electrics
- 1 Code Receiver, 6' diameter, 18' long

CLASSIFIERS

- 1 Dorr Duplex Rake, 48" x 17'
- 1 Dorr Duplex Rake, 60" x 26'
- 1 Wemco Bowl 12', 48" x 31'

FLOTATION

- 8 cells Fagergren 56", NEW
- 18 cells Fagergren 56", used

HOISTS, ELECTRIC

- 1 Taylor 100 HP 2 Drum
- 1 Lidgerwood 250 HP 2-Drum
- 1 Wellman 500 HP 2-drum

HOISTS, AIR, Reconditioned

- 3 Sullivan Model E-11, single drum
- 1 Ing. Rand Model D6U single drum
- 1 Ing. Rand Model D6UL, single drum
- 1 Gard. Denv. Model HK, single drum
- 2 Sullivan Model F-113, single drum
- 1 Sullivan Model S-211, double drum
- 8 Ing. Rand, Model A4NNOJ, double drum
- 1 Gard. Denv. Model HEE, double drum
- 2 Sullivan Model, FF-211, double drum
- 1 Ing. Rand, Model HS, double drum
- 1 Ing. Rand, Model HNNJ, double drum
- 1 Sullivan HDA-2, double drum

MOTORPUMPS, Reconditioned

- 1 Byron Jackson, Size 3" BNM 10 HP
350 gpm at 65' head
- 1 Ingersoll Rand, 1½ RV1½ 1½ HP
60 gpm at 60' head
- 1 Ingersoll Rand, 1KRV5¼ ¼ HP
35 gpm at 15' head
- 1 Ingersoll Rand, 2RVH7½ 7½ HP
200 gpm at 100' head
- 1 Byron Jackson 1-1½ 1½ HP
31 gpm at 80' head
- 1 Ingersoll Rand, 1½ RVH7½ 7½ HP
100 gpm at 150' head
- 1 Ingersoll Rand, 2MRV40 40 HP
260 gpm at 460' head
- 1 ASH Hydrosol Pump, Size A
- 1 ASH Hydrosol Pump, Size AA

MISCELLANEOUS

- 1 Eimco 12-B Mucker, 18" gauge
- 1 Mancha Electric Mule, 18" gauge with
charger and battery
- 2 Atlas Trammers, 18" gauge with charg-
ers and batteries
- 2 Gen. Elect. Trammers, 18" gauge with
chargers and batteries
- 1 Goodman Trammer, 18" gauge with
charger and battery
- 1 Symons 4' x 8' red deck screen, NEW
- 1 DFC #2 Laboratory Crusher with motor
- 1 C-H 18" Magnet with motor-generator
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- 1 Boyes Bros JV Diamond Drill
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- 8-TM8 Coppus Ventair, 15 HP, 440 V
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- 1-6000 CFM Roots Connersville, RS, 150 HP, 2200 V

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- 18-18 cu. ft. C. S. Card, Z18, 18" ga.
- 41-20 cu. ft. C. S. Card, Z30, 18" ga.
- 11-30 cu. ft. C. S. Card, Rockdum, 24" ga.
- 32-33 cu. ft. Ajax Type, 18" ga.
- 25-60 cu. ft. C. S. Card, Granby, 30" ga.
- 32-37-1/2 cu. ft. Ajax Type, 18" ga.
- 14-84 cu. ft. C. S. Card, Granby, 30" ga.
- 5-85 cu. ft. C. S. Card, Granby, 30" ga.
- 7-100 cu. ft. C. S. Card, Side Dump, 30" ga.
- 14-130 cu. ft. C. S. Card, Granby, 30" ga.

Compressors

- 2-300 CFM Gardner Denver, HAC, 100 HP, 440 V
- 1-625 CFM Ingersoll Rand, XCB, 125 HP, 2200 V
- 1-875 CFM Ingersoll Rand, XRE, 175 HP, Rym.
- 2200 V
- 1-1000 CFM Chicago Pneumatic, OCB, 200 HP, 440 V
- 1-1050 CFM G. D. BA, 200 HP G. E., 2200 V
- 1-1500 CFM Worthington, 300 HP, 2200 V
- 1-2000 CFM Worthington, 27" x 16 1/2" x 18", 400 HP, 2300 V
- 1-2500 CFM Sullivan, WN4, 400 HP West, 2200 V
- 1-3000 CFM Ingersoll Rand PRE-2, 575 HP, 2200 V

Converter

- 1-300 KW Westinghouse, 600 Volt DC

Generators

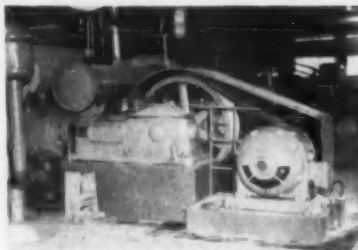
- 1-50 KW G. E. M-G Set, 125 Volt DC
- 1-100 KW Western Electric M-G Set, 125 Volt DC
- 2-100 KW G. E. M-G Set, 250 Volt DC
- 1-150 KW Western Electric, 150 Volt DC
- 1-150 KW Westinghouse M-G Set, 250 Volt DC
- 1-150 KW Westinghouse M-G Set, Volt DC
- 1-75 KW Caterpillar D13, 600, 220/440 Volt, Diesel
- 1-100 KW Caterpillar D13, 600, 440 Volt, Diesel

Hoists

- 2-40 HP Coeur d'Alene Single Drum, Excellent
- 1-75 HP Puget Sound Single Drum
- 1-170 HP Allis Chalmers Double Drum
- 1-300 HP Wellman Seaver Morgan, Single Drum
- 1-600 HP Vulcan Double Drum, 2300 V
- 1-800 HP Nordberg Double Drum, Excellent

Locomotives

- 17-1 1/2 Ton Mancha Battery, 18-24" ga.
- 3-1 1/2 Ton Atlas Type J, Battery, 18" ga.
- 1-2 1/2 Ton Jeffrey, 18" ga.
- 1-3 1/2 Ton Mancha Titan AX, 18" ga.



500 CFM Gardner Denver Compressor

- 8-4 Ton Jeffrey Type Battery, 18" ga.
- 1-7 Ton Plymouth Diesel, 18" ga.

Lamps

- 198-MRA Battery Cap, Model R4, W/racks & Charger

Motors

- 1-100 HP General Electric, 440 V, 860 rpm
- 1-200 HP General Electric, 2200 V, 435 rpm
- 1-225 HP Westinghouse, 2200 V, 360 rpm
- 1-350 HP Westinghouse, 2200 V, 360 rpm
- 1-750 HP General Electric, 2200 V, 360 rpm

Mucking Machines

- 4-12B Elmco Mucking Machines, 24" ga.
- 8-GD-9 Gardner Denver, 18" ga.

Classifiers

- 1-45" x 17'-3" Akino Spiral w/dive
- 1-36" x 15'-9" Wemco, Model SCM, Spiral
- 1-7' x 25'-6" Durr D8FX, Bake Type

Crushers, Jaw

- 1-36" x 48" Traylor Bulldog
- 1-36" x 48" Birdshero Buchanan
- 2-60" x 24" Traylor Crushing Rolls, Type AJO
- 1-15" x 33" Universal Jaw, 50 HP Motor, 440 V
- 1-15" x 24" Cedar Rapids Crushing Plant

Filters

- 1-3' x 4' Oliver Drum
- 1-6' x 6' Oliver, Stainless Steel, complete
- 1-4', 1 leaf Elmco, complete

Fotation Machines

- 1-6 cell No. 18, Denver Sub A
- 4-2 cell, 48" x 48" Agitator, 15 HP

- 2-8 cell, 56" x 56" Fagergren, Level Type
- 1-5 cell, 18 Spec., 32" x 32" Denver
- 1-5 cell, 44" x 44" Wemco Fagergren, Excellent

Jigs

- 1-26" x 26" Bendalari Simplex
- 3-12" x 18" Denver Duplex, complete w/dive
- 1-8 x 12 Denver Simplex, complete w/dive

Magnets

- 1-24" x 30" Dings Bipolar, 230 Volt
- 1-26" x 24" Dings Magnetic Head Pulley

Mills, Ball & Rod

- 14-8 x 6 Marcy Type Ball Mills
- 6-6 x 12 Allis Chalmers Ball Tube Mills
- 2-6 x 9 Allis Chalmers Ball Mills
- 1-5 x 8 Traylor Rod Mill, 150 HP, 440 V
- 5-8 x 9 Traylor Ball Mill, 250 HP, 2200 V
- 1-7.6 Allis Chalmers, 250 HP, 440 V
- 1-6 1/2 Marry Ball Mill, 100 HP
- 1-6 x 4 Denver Ball Mill 100 HP
- 1-3 x 8 Hendy Rod Mill, 30 HP

Pumps, Sand

- 3-2 x 3 ASH Hydrosol Sand Pumps, A Frame
- 10-3 x 4 ASH Hydrosol Sand Pumps, B Frame
- 3-3 x 6 ASH Hydrosol Sand Pumps, C Frame
- 1-4" Galigher Vac-Seal, 30 HP, 440 Volt
- 1-4" Wemco, rubber lined, 30 HP, 440 V
- 6-6" Wilbey, Model C, 75 HP, 2200 Volt

Screens

- 1-3' x 6' Symons Rod Deck
- 1-4' x 8' Symons Rod Deck
- 1-18" x 36" Denver Dillon Single Deck
- 1-3' x 10' Allis Chalmers Single Deck
- 14-4' x 5' Tyler Hammer, Single Deck
- 6-3' x 8' Tyler Single Deck
- 2-4' x 10' Tyler Hammer Single Deck

Tables, Concentrating

- 1-158 Deister, Laboratory, 110V Motor
- 1-7' x 15' Deister Plato, 1 1/2 HP, 220/440 V
- 1-Size 6S Wilbey, 1 1/2 HP, 220/440 V

Thickeners

- 1-38 1/2" x 8' Denver Spiral, Steel Tank
- 1-50' x 9' Dor "Torque", Type 8
- 10-18 1/2" x 8' Dorco & Wemco, Steel Tank
- 2-17' x 6' Dorco, Low Head
- 1-22' x 6' Wemco, Low Head

Transformers

- 5-230 KVA G. E., 2400-240/480 V
- 1-200 KVA G. E., 22,000-2300 V
- 3-300 KVA Westinghouse, 2300-440 V
- 4-333 KVA G. E., 22,000-2300 V
- 4-500 KVA G. E., 22,000-240/120 V

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- 1—30 HP Vulcan #22C
- 1—37 HP Single Drum
- 1—40 HP Vulcan #22C
- 2—50 HP H & B
- 1—50 HP Fairbanks-Morse
- 1—50 HP Vulcan
- 1—50 HP Box
- 1—75 HP Vulcan
- 2—100 HP Box
- 1—112 HP Vulcan
- 2—125 HP Ottumwa
- 2—150 HP Vulcan
- 2—200 HP Ottumwa
- 1—250 HP Ottumwa

HOISTS—DOUBLE DRUM ELECTRIC

- 1—75 HP with Post Brakes
- 1—75 HP Vulcan #80D, Post Brakes, 75 HP Motor & 50" steel head frame
- 1—82 HP Vulcan #5½
- 1—100 HP Webster, Clamp & Lane
- 1—150-200 HP Ottumwa
- 1—150 HP Jackson

AIR TUGGER HOISTS

- 1—Ingersoll-Rand Model DU
- 2—Ingersoll-Rand Model D8U
- 4—Ingersoll-Rand Model IH
- 1—Sullivan Model E-111
- 9—Ingersoll-Rand Model EUA
- 1—Ingersoll-Rand Model 10-H
- 8—Gardner-Denver Model HK
- 2—Joy "Turnbair" Model F-113
- 1—Sullivan Model L-111
- 2—Ingersoll-Rand Model 10HR
- 1—Sullivan Model HA 3
- 3—Ingersoll-Rand Model H4

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- 4—5 HP Sullivan, 2 drum slushers
- 1—5 HP Sullivan tugger
- 2—7½ HP Sullivan tuggers
- 1—10 HP Sullivan 3 drum slusher
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- 4—Joy Model FF211
- 1—Ingersoll-Rand Model HNN-1J

LOADERS

- 17—Eimco 12B, 18" ga.
- 8—Eimco 21, 18" & 24" ga.
- 3—Gardner-Denver Model 9, 18" ga.
- 1—Joy HL3, 18" ga.
- 1—Joy HL20, 24" ga.

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- 1—24" x 20' Link-Belt
- 1—42" x 18' Stephens-Adamson

DRILLING EQUIPMENT

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- 20—Ingersoll-Rand Model JR38A Jack Drills
- 7—Gardner-Denver Model FL48-4 Air Leg Drills
- 3—Thor Model 390 Air Leg Drills
- 6—Atlas Copco Model BB122 Jack Drills
- 6—Ingersoll-Rand Model DA35 Drifters

GYRATORY CRUSHERS

- 1—2" Symons Cone
- 1—12" Traylor Type T
- 1—2" 4" Traylor Type TY
- 1—3" Traylor Type TY

PUMPS—SAND

- 3—1" Denver
- 1—1½" Kimball-Krogh
- 1—1½" Vacaseal
- 2—2" Denver
- 2—2" A.S.H. Hydrosael
- 2—2" Vacaseal
- 2—2" Wilfley
- 1—3" A.S.H. Hydrosael
- 2—3" Wilfley
- 2—4" A.S.H. Hydrosael
- 1—4" Wilfley
- 1—6" Amasco

SCREENS

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- 1—3' x 6' Robins Gyrex
- 1—4' x 10' Allis-Chalmers Double Deck

TANKS

- 4—9' x 11'6" Acid Storage Tanks
- 1—25,000-gal. Steel Tank

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- 1—4' x 4' Marcy Ball Mill
- 1—6' x 4' Hardinge Conical Ball Mill
- 1—6' x 6' Allis-Chalmers Ball Mill
- 1—7' x 5' Allis-Chalmers Ball Mill
- 1—8' x 22' Hardinge Conical Ball Mill
- 1—3' x 8' Morse New Rod Mill
- 1—4' x 10' Hardinge Rod Mill
- 2—5' x 10' Traylor Rod Mills

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- 6—2¼" x 3½" New Morse Lab Crushers
- 6—4' x 6" New Morse Lab Crushers
- 1—4½" x 7" Heady Jaw Crusher
- 1—8' x 15" Wheeling Jaw Crusher
- 1—9' x 18" Day Jaw Crusher
- 1—9' x 16" Universal Jaw Crusher
- 1—10' x 16" Universal Jaw Crusher
- 1—12" x 24" Universal Jaw Crusher
- 1—3' x 36" Cedar Rapids Jaw Crusher
- 1—42" x 48" Traylor Jaw Crusher

CONCENTRATING TABLES

- 10—Deister Diagonal Deck Right Hand
- 10—Deister Diagonal Deck Left Hand
- 5—Deister Overstrom Diagonal Deck Left Hand

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- 6—1½ Ton Mancha "Trammers"
- 1—½ Ton General Electric Battery Locomotive
- 3—¾-4 Ton Mancha "Titan A" Battery Locomotives
- 1—4 Ton Westinghouse Battery Locomotive
- 1—4 Ton General Electric Trolley Locomotive
- 1—6 Ton Goodman Trolley Locomotive
- 1—6 Ton Jeffrey Trolley Locomotive
- 2—6 Ton General Electric Battery Locomotives
- 2—7 Ton General Electric Battery Locomotives
- 1—7 Ton Jeffrey Trolley Locomotive
- 1—7 Ton Atlas Battery Locomotive
- 2—8 Ton Goodman Battery Locomotives
- 2—8 Ton General Electric Battery Locomotives
- 3—8 Ton Ironton Battery Locomotives
- 1—8 Ton Whitcomb Battery Locomotive
- 4—10 Ton Atlas Battery Locomotives
- 2—10 Ton Jeffrey Trolley Locomotives
- 1—13 Ton Jeffrey Trolley Locomotive
- 1—13 Ton Goodman Trolley Locomotive
- 1—15 Ton Jeffrey Trolley Locomotive

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- 3—150 KVA West., 4160/7200Y—120/240.
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- 1—Hammermill, Penna. Crusher 400 HP, non-clog, #5040, UNUSED
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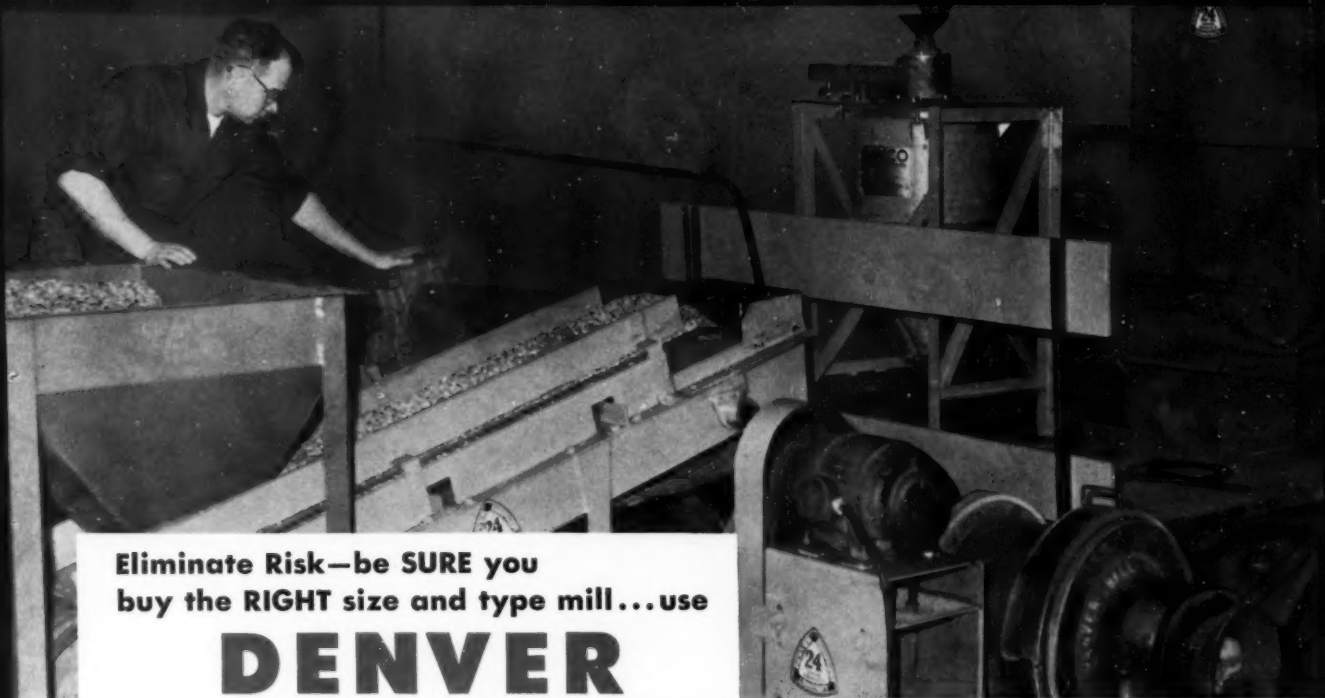
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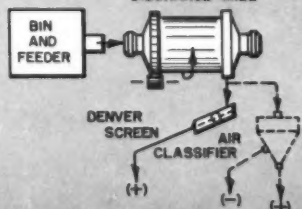
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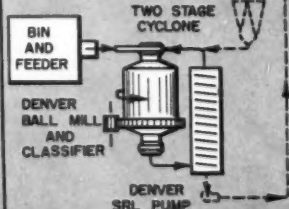
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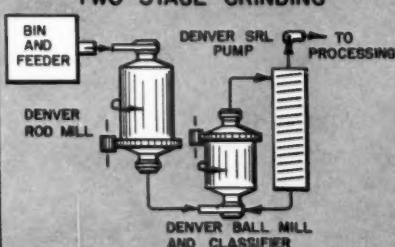


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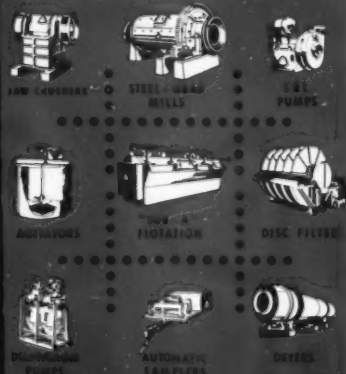
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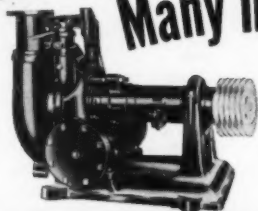
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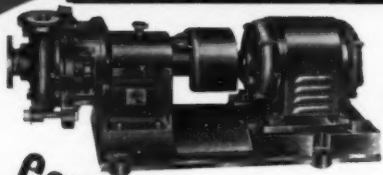
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